CONTENTS OF AMERICAN MUSEUM NOVITATES

NUMBERS 513 TO 589

1932

The Title-page, Table of Contents, and Author Index to this volume of Novitates (Nos. 513 to 589, inclusive), published November, 4, 1936.

The edition of Novitates is 1000. Copies are mailed on the date of issue, and the remainder of the stock is placed on sale in the Library.

AUTHOR INDEX

NOVITATES 513 TO 589

ERRATA

No. **520.** Page 3, line 11 from top: for Solomong read Solomon.
" **521.** Page 12, line 14 from top: for hypopyguim read hypopygium.
" **522.** Page 17, line 21 from top: for staft-streaks read shaft-streaks.
" **524.** Page 12, line 8 from bottom: transpose "PERU: Apayacu, Rio Amazonas, 2 ♀, to line 10 from bottom, after Morelia, 1 ♂.
" **525.** Page 22, line 2 from bottom (footnote): for 1,800 to 1,900 read 18,000 to 19,000.
" **527.** Page 11, under Fig. 2, for *Inercus* read *Quercus*.
" **530.** Page 3, line 19 from top: for squence read sequence.
" **530.** Page 4, line 3 from top: for pp. read p.
" **538.** Page 7, line 22 from top: for Americon read American.
" **538.** Page 9, line 13 from bottom: omit comma after *cantator*.
" **538.** Page 11, line 22 from top: for *M. c. peruviana* read *H. c. peruviana*.
" **540.** Page 7, line 13 from bottom: for Nos. 21532–35 read 21532, and 21534–35.
" **542.** Page 4, line 2 from top: for cannabilistic read cannibalistic.
" **543.** Page 4, line 9 from top: for conditon read condition.
" **547.** Page 4, line 13 from bottom: for *Megachille* read *Megachile*.
" **547.** Page 8, line 12 from bottom: for *M. garua* read *N. garua*.
" **549.** Page 24, line 11 from top: for **Tropidophus** read **Tropidophis**.
" **551.** Page 2, line 16 from top: for *dearboni* read *dearborni*.
" **553.** Page 2, line 5 from bottom: the abbreviations n. sp. after *Pappichthys? mongoliensis* should be transferred to line 6 from bottom after *Pappichthys mongoliensis*.
" **553.** Page 8, line 9 from top: take out comma after teeth.
" **553.** Page 15, line 10 from top: for Iran Dabasu read Iren Dabasu.
" **554.** Page 8, line 2 and line 20 from top: for *Crypterullus* read *Crypturellus*.
" **555.** Page 16, line 8 from top: for is read are.
" **558.** Page 9, line 14 from bottom: for (Huallaga) read (Marañon).
" **558.** Page 19, line 9 from top: for *Ceromacra* read *Cercomacra*.
" **584.** Page 14, line 10 from top: for *bolivianus* read *boliviana*.

AMERICAN MUSEUM NOVITATES

Number 513 — Published by THE AMERICAN MUSEUM OF NATURAL HISTORY, New York City — Jan. 29, 1932

59.79: 15, 6

EXPERIMENTS ON THE EGG-LAYING OF SALAMANDERS

By G. K. Noble and L. B Richards

The discovery that implants of the anterior lobe of the fresh pituitary gland will induce a normal egg-laying in a salamander several months before the usual season (Noble and Richards, 1930) has opened up the possibility of employing this technique in securing the previously undescribed eggs of other species. It has recently been emphasized (Noble, 1927) that the mode of life history of an amphibian often furnishes a valuable clue as to the relationships of the species. The pituitary technique, inducing a normal ovulation, should be of interest, therefore, not only to embryologists but to students of amphibian phylogeny who are able to secure the adults of the rarer species alive.

With a view to securing data of phylogenetic interest we have induced several salamanders whose eggs were previously unknown to lay in the laboratory. Before describing the eggs of these species under separate headings, we have reported our preliminary experiments with *Eurycea bislineata* in some detail, because these experiments form the basis of our assuming that a normal egg-laying will follow the pituitary treatment.

The Egg-Laying of *Eurycea bislineata bislineata*

In our first experiments with *Eurycea bislineata,* we implanted during November, December, and January, twenty-eight adult females with anterior pituitaries removed from others of the same species, while thirteen controls received muscle. Nineteen of the twenty-eight laid, but none of the controls. As previously reported (Noble and Richards, 1930), the females were maintained in separate crystallizing dishes 20 cm. in diameter. A few stones were arranged in each dish in such a way that they formed a bridge under which the salamander could freely move. The water in the dish barely covered the stones. The eggs were laid and attached by stalks to the under surface of the rocks. The average number of eggs laid was twenty-five, maximum number forty-one, minimum three. In only two of the nineteen cases were there any mature eggs left in the ovaries at the close of egg-laying. Hence, *E. bislineata* lays a variable number of eggs.

In this first series of experiments we varied the time between implants with rather striking results. In the case of seven females, only three of which laid, the implants were given a week apart. Of eight specimens, implanted on alternate days, six laid. The remaining thirteen females laid after a single implant. From November 17, 1930, to January 9, 1931, we implanted a second series of thirty adult *Eurycea bislineata* on alternate days, and in this case twenty-six laid. This second series was intended to determine if the thymus had an influence on egg-capsule formation and thymectomy was attempted before the pituitary treatment. The females in this second series also received the pituitaries of their own species. Whether or not all of the thymus was removed from each of the females has not been determined at the present time. In spite of the fact that a large part at least was extirpated, the egg-capsules of all the eggs had their usual form. Further, the eggs were attached to the under side of the stones in the dishes in the normal manner.

By combining the two series it may be said that we have induced forty-five *Eurycea bislineata* to lay out of season in the laboratory. All attached their eggs in the normal manner to the under side of stones although these were placed in crystallizing dishes with fresh but not running water. Our breeding dishes represented only an approximation to conditions found in the brooks where *E. bislineata* lays its eggs, but we could detect no deviation from the normal method of egg-laying.

The manner in which the female deposited her eggs was essentially the same in all cases. Our most detailed records were made November 22, 1929, on specimens G, J, and L. The female clings, upside down, to the under surface of a flat rock. The back and tail are arched so as to bring the cloacal lips in contact with the rock. A place is "felt out" on the stone by the slightly protruding cloaca and the egg deposited. The time between the deposition of each egg depends upon the amount of wandering about the salamander does. In one case the female moved, methodically, a few centimeters after depositing each egg. She required on an average three minutes for the attachment of an egg. This female, G, came to the edge of the rock once during the laying period and put her nose out of water She remained upside down for a minute in this position and then backed down under the rock to resume her egg-laying. None of the animals observed were seen to lay eggs loose on the bottom of the dish. A few eggs were knocked off by the female swishing her tail as she located the next place to lay. Another female, L, continued to lay while maintaining a position with head out of water. In this posi-

tion the body was, as usual, upside down, but the forelimbs did not make contact with the rock. They were thrust out awkwardly to either side. At frequent intervals the female left this position and climbed up on top of the rock out of water. Other females, also, came out of the water during egg-laying and then returned to approximately the original position to continue ovipositing. A single well-defined cluster of eggs is often not deposited at one time, as one might assume, but is laid by a female who has made several short excursions away from the breeding rock at intervals during the period of oviposition.

The eggs deposited by the females were for the most part fertile, showing that many female *Eurycea bislineata* carry sperm in their spermathecæ during the winter months. We reared some of the larvæ under a variety of conditions but were much more successful with running water than with still water

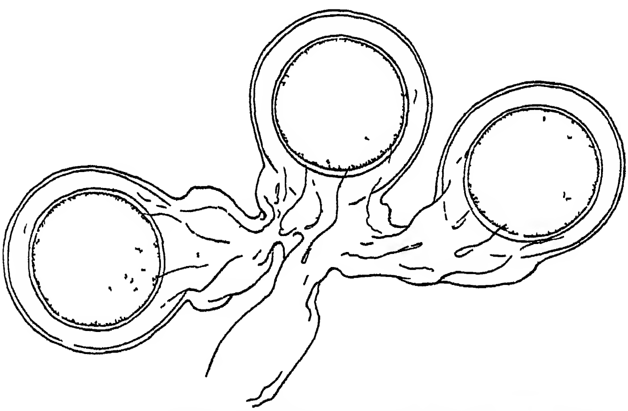


Fig. 1. Variation in egg-stalk of *Eurycea bislineata cirrigera* (Green). Fixed in formalin. ×7½.

EXPERIMENTS WITH *Eurycea bislineata cirrigera*

In March 1930, we received from Mr. G. D. Ellis, in a collection of living salamanders from Winton, N C., a lot of *Eurycea* eggs attached singly or in small clumps to water-weed and to bits of dead vegetation. The eggs were attached by short stalks and as many as eighteen were grouped on the same branch of water-weed with their bases in contact or very close together. It was apparent that the eggs had been laid in the field, for Mr. Ellis wrote of observing many. Some of these eggs were raised and the larvæ identified as *E. b. cirrigera*.

On April 9, 1931, a second collection of eggs laid in the field was

received from Mr Ellis, at Winton N C. The eggs were in eight lots, each lot having been laid presumably by a single female. As before, the eggs were attached by stalks to pieces of dead leaf, twigs, and moss. The number of eggs laid by one animal ranged from one to thirty-four, with an average of twenty Several of the eggs were loose in the bottom of the container but, as they were stalked, it is probable that they were detached en route. In one case there were three eggs with a single common stalk (Fig. 1) and, on the same twig, two eggs with one stalk. This variation, the only one of its kind in this group of 159 eggs, shows a tendency toward the form of egg-capsule found in *Desmognathus fuscus*. The capsules of the remaining 154 eggs were essentially the same as those of *Eurycea bislineata*, although the stalks varied much more in length

The region near Winton, N. C., where the eggs were collected, lies in the coastal plain and, according to the unpublished observations of Mr. M. K. Brady, rocks do not occur in the streams. The question occurred to us, if *E. b. cirrigera* were given the choice between water-weed and a stone bridge, would it revert to the habits of *E. b. bislineata*. It is probable that many of the recorded differences in mode of life history of salamanders might be environmental and not hereditary. Would *Pseudotriton montanus*, for example, forced to breed in stony brooks, not lay its eggs on the under side of the stones in the manner of its close relative *P. ruber ruber* instead of scattering them among leaves in the way Brimley (1923) described? Here the testimony of induced egg-laying might yield interesting results.

We received from Mr. Ellis a large number of *E. b. cirrigera* swollen with eggs. We arranged a tank 30 cm.×75 cm. at the base, containing a stone bridge and several strands of water-weed in water of about 3 to 4 cm. in depth. A feeble current was maintained running the full length of the tank. Several females that had been previously kept in an ice box for several months were introduced into the tank. As indicated elsewhere (Noble, 1930), five of these laid their eggs attached to the under surface of the stone bridge. No eggs were attached to water-weed. It is possible that the water-weed was not of sufficient quantity or quality to attract the salamanders, but in view of the rather indiscriminate selection of vegetation in nature this suggestion does not appear likely. Apparently *E. b. cirrigera* would prefer to attach its eggs to the under side of stones but in the coastal plain habitat these are not available to the race. We could find no constant differences between the eggs of *E. b. cirrigera* when attached to stones and those of *E. b. bislineata* under the same condition.

Experiments with *Stereochilus*

The eggs of *Stereochilus marginatum* were unknown when we began our study. The species is not closely related to the other plethodontids of the coastal plain. Dunn (1926, p. 247), in his review of the family, remarks that the "species seems very isolated and it is scarcely profitable to speculate on its relationship" It seemed to us that the eggs of *Stereochilus* might throw some light on its relationship and hence we have endeavored to secure them under as natural a setting as possible. Since we had no information as to what this setting might be, we arranged a series of crystallizing dishes with various amounts of water, moss, sticks, and sand and introduced implanted females into these dishes where they could make a selection between a variety of "nesting sites."

For the work we selected twenty female *Stereochilus* collected December 14 to 19, 1929, at Winton, N. C., and maintained for nearly a year in large tanks of running water at the American Museum. From December 19, 1930, to January 11, 1931, we implanted these salamanders with fresh anterior pituitary glands secured from *Rana pipiens* before each operation. Nineteen of the twenty *Stereochilus* laid, the average number of eggs being fifty-seven, including the eggs eaten by the females during or immediately after oviposition. The females were maintained in separate dishes and four days after the last egg was laid they were preserved and the stomach contents noted. Six of the nineteen females ate some of their eggs. Examination of the ovaries and oviducts revealed that, had the females laid all the eggs mature at this time, the average number in each laying would have been seventy (maximum 121, minimum 16).

The females were divided into four groups of five individuals each, and the various groups subjected to different situations for egg-laying. The dishes in all cases were the same size, 25 cm. in diameter, but they were arranged with different material and amounts of water The dishes of the first group included moss, sand, sticks, and water-weed, each with equal areas above and below water. The dishes of the second group included also moss, weed and sand but had only a fourth as much free water as sand and moss above the water The third group was given a stone bridge and no water-weed. The bridge covered about half of each dish which was filled with water to the depth of 5 cm. The last group was given similar dishes but several strands of water-weed were allowed to float in the water. In this way the implanted *Stereochilus* were given the opportunity of laying their eggs under a wide variety of conditions.

Of the first group four out of five laid, the one that failed to do so having become infected. One laid after one implant, two after two implants, and the remaining one after four. Two laid at night, another under cover, and only one of this group permitted observations on the details of egg-laying. This individual (K in our records) received the first implant January 6 and another the following day. On January 10 she began to lay about 9 A.M. and continued throughout the day. It is uncertain when this individual finished laying because she was not observed again until January 12 when the laying was completed. The eggs were attached singly to water-weed in the water and confined to a limited portion of the weed where they tended to form a group. There were sixty-seven eggs in the lot and only one mature egg was later found in the ovaries.

The method of oviposition was of especial interest. Although the water-weed floated freely and could be approached from any side, the ovipositing female invariably turned over on her back before egg-laying. In some instances only the posterior part of the body was fully twisted, the anterior part being turned to one side and braced by the forelimb of that side (Fig. 2A). In such a position the body and tail were arched and the hind limbs free of support. In spite of the awkwardness of the position the female would "feel out" a suitable spot on a strand of submerged water-weed or moss with her slightly protruding cloacal lips and slowly push forth an egg from the cloaca until its very adhesive outer capsule came in contact with the selected spot. The time required for the extrusion of a single egg varied from approximately one to five minutes. Usually after laying an egg the salamander would regain her upright posture and walk about among the eggs and weed for a few minutes. Occasionally, after twisting the body and finding a suitable place for attaching the egg, there was a wait of from two to three minutes before the egg appeared between the lips of the cloaca. Although the salamander generally attempted to support the anterior part of the body with one forelimb while ovipositing, on several occasions this brace was withdrawn and the female turned completely over on her back (Fig. 2B).

During the day that this ovipositing female was under observation she was never seen to raise her head above the surface of the water. This is the more remarkable in that *Stereochilus* like other plethodontid salamanders fails to practice bucco-pharyngeal respiration when in the water. The nostrils are tightly closed and powdered carmine placed in the water shows no currents entering or leaving the mouth. Hence, during the period of egg-laying, *Stereochilus* may depend entirely on

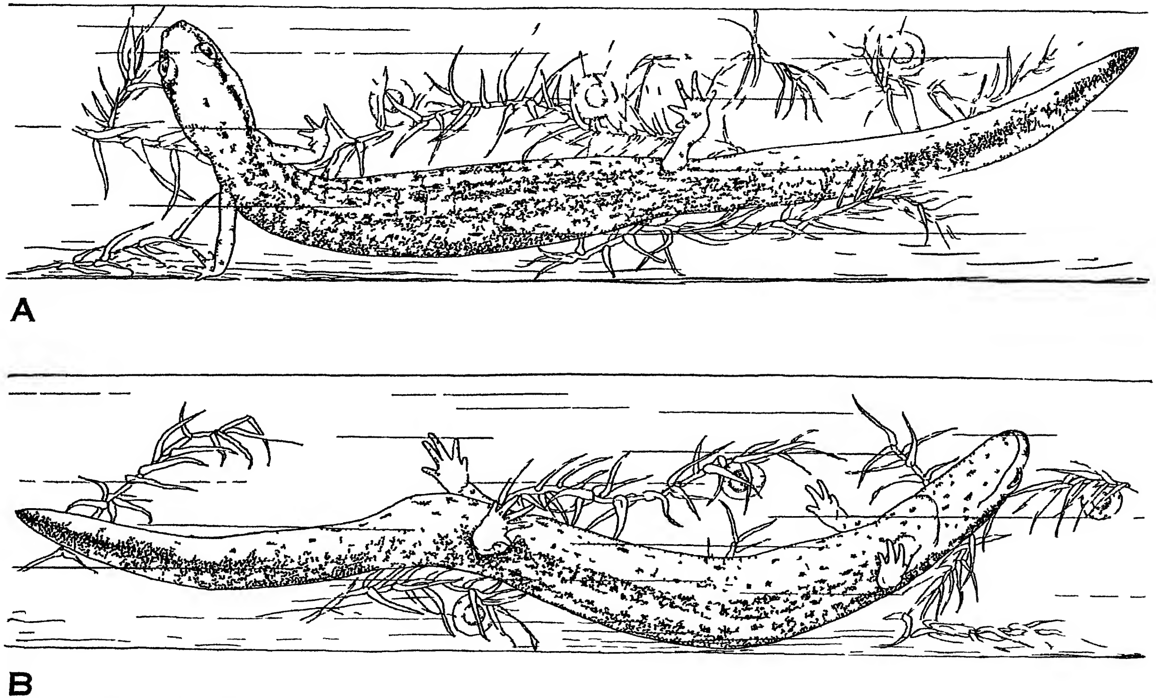


Fig 2. *Stereochilus marginatum* (Hallowell). Specimen "K," in positions assumed during oviposition ×1½

cutaneous respiration. Subsequent observation, however, showed that this was not the rule, that usually ovipositing *Stereochilus* thrust its head above the surface and took air into the buccal cavity.

The three other salamanders of the first group did not all lay their eggs attached to water-weed in the water. Individual A of the series laid its eggs, seventy-nine in number, in the same manner as K. Individual N, however, laid thirty-one eggs on the underside of a sheet of moss which was only half submerged. Although the salamander's body was covered by the moss, her upside-down position was readily noted especially during the moments the head was thrust above the surface of the water. Later this female laid eleven unattached eggs free in the water. Possibly our examining the "nest" caused the animal to abandon her original site. The last salamander, C, of the first series laid a total of seventy-two eggs but only twelve were attached to water-weed as in "A" and "K," sixteen were loose in the water and forty-four were scattered on the wet sand just out of water. The egg-capsules of all the eggs laid out of water were swollen and slightly flattened, apparently due to their own weight. Although these eggs were left undisturbed, none developed, while those in the water began to develop normally.

In the second series of experiments the crystallizing dishes were partly filled with sand, moss, small stones, and leaves. A small pool was constructed in such a way that it occupied about a fourth of the total area of the bottom of the dish. The thought was that, if *Stereochilus* preferred a land to a water habitat for its eggs, ample opportunity would be available in these dishes. All five salamanders in this series laid: the first deposited thirty-three eggs after 12 implants, the second twenty-one eggs after two implants, the third fifty-seven eggs after one implant, the fourth nineteen eggs after one implant, and the last fifty-one eggs after one implant. Three of the five salamanders were observed while laying. Although the basin of water was very small, one salamander "T" laid in exactly the same manner as "K" described above. Another salamander "S" laid during the night, but since all the eggs were attached to water-weed in one portion of the basin we may assume that this individual also agreed with "K" in its manner of egg-laying. Two others, "Q" and "U" of the series, laid on the under surface of a piece of sheet moss lying partly submerged at the edge of the water. Aga n the observed females remained upside down during oviposition and frequently thrust their heads out until one or both nostrils were above the surface of the water. We have never seen any other species of

salamander remain with only one widely open nostril above the surface of the water but we observed this behavior several times in these two females. We were able to determine by binocular examination that the valve closing the nostril is not opened until the surface is reached and is closed tightly the moment the nostril is drawn below the surface.

The last salamander, F, of the second series differed from the others in manner of egg-laying, but since it did not agree with "C" or with any in the first series its method is probably abnormal. The salamander began to lay at 2 P.M. and continued to lay at intervals throughout that afternoon and the following day. The first two eggs were merely extruded into the water. Ten minutes later the salamander assumed a position of rest on the edge of the pool with head and forelimbs out of water, but the hind limbs and posterior part of the body submerged. The tail was curved upward and bent slightly to the left but there was no other attempt to assume the inverted position. This was the female which had received twelve implants, and except for the first two eggs almost the entire batch of thirty-three eggs was laid in this one spot. It is possible that excessive chloretonizing or other feature of the treatment had affected this salamander, preventing a normal behavior. Nevertheless, the salamander wandered about considerably while not ovipositing, always returning to the same spot. The interval between the laying of successive eggs varied from thirty seconds to fifteen minutes.

The third group of *Stereochilus* was given the "*Eurycea bislineata* habitat" described above. Two or three flat stones were arranged to form a bridge under which the salamanders could easily crawl. The stones were covered with water but no water-weed was added to these dishes. All of the salamanders in this group laid: one depositing one hundred and twenty-one eggs after five implants, a second only sixteen eggs after seven implants, a third twenty eggs after three implants and the last seventy-four eggs after two implants. An average of 82 per cent of the eggs were laid attached to the stones. A few others were very probably broken loose accidentally by the female after they had been attached to the stones. Observations were made on three of the salamanders in this series while they were laying. *Stereochilus* lays its eggs in a manner very similar to *Eurycea bislineata bislineata* under the same conditions. The female clings upside down to the under surface of a flat stone. The rock is usually gripped by the female with her front limbs, although occasionally the hind limbs are also used for support. Her back and tail are arched, her cloacal lips slightly protruded and then cautiously brought forward to "feel out" a suitable place for egg attachment. At

the moment the egg appears between the lips of the cloaca the latter is brought tightly against the rock and the egg, adhering firmly to the rock by its outer capsule, is pulled from the cloaca. The extrusion time is approximately as long as when water-weed formed the substratum (K). After laying one egg the salamander moves on to a new spot and again brings her protruding cloacal lips in contact with various parts of the surface before settling down to lay another egg. When walking the tail is switched slowly from side to side and while this tends to carry the salamander forward it sometimes knocks newly laid eggs from their attachment.

During the process of egg-laying the female frequently comes to the edge of the rock and thrusts her head out of water while maintaining the inverted position. In some cases the salamander may continue laying while the nostrils are above the surface. In order to test this oxygen requirement further, we raised the water in the dishes to a depth of 6 or 7 cm. after two salamanders (P and M) had begun to lay. Both salamanders continued to make efforts to reach the surface. Usually the hind legs and tail remained in contact with the under surface of the rock while the forelimbs assumed an awkward position at nearly right angles to the upwardly directed body. One salamander (M) was observed to lay an egg while her body was in this vertical position and the cloaca not in actual contact with the rock. It is clear that *Stereochilus* will make a considerable effort to breathe air at intervals during the period of egg-laying, although our observations on "K" would indicate that the female is also capable of remaining submerged for a long time during this period.

The fourth and last group of *Stereochilus* was placed in dishes provided with stone bridges as in the case of the third series but, in addition, water-weed was added. The weed was of the same species and arranged approximately as thickly as in the first series of experiments. All the salamanders in this group laid. One deposited seventy eggs after seven implants, another one hundred and ten eggs after six implants, a third fifty-seven eggs after two implants, a fourth sixty-three eggs after two implants and the last forty-eight eggs after one implant. In no case were the eggs attached to water-weed. With the choice of weed and stone 71 per cent of the eggs were attached to the stones, the remainder being free in the bottom of the dishes. As indicated above, many of these loose eggs may have been knocked from the rocks by accident while the female was switching her tail back and forth during the "feeling out" phase of egg-laying. Two salamanders of the series were observed in the act of egg-laying. Their behavior was exactly the same as in the case of the third group.

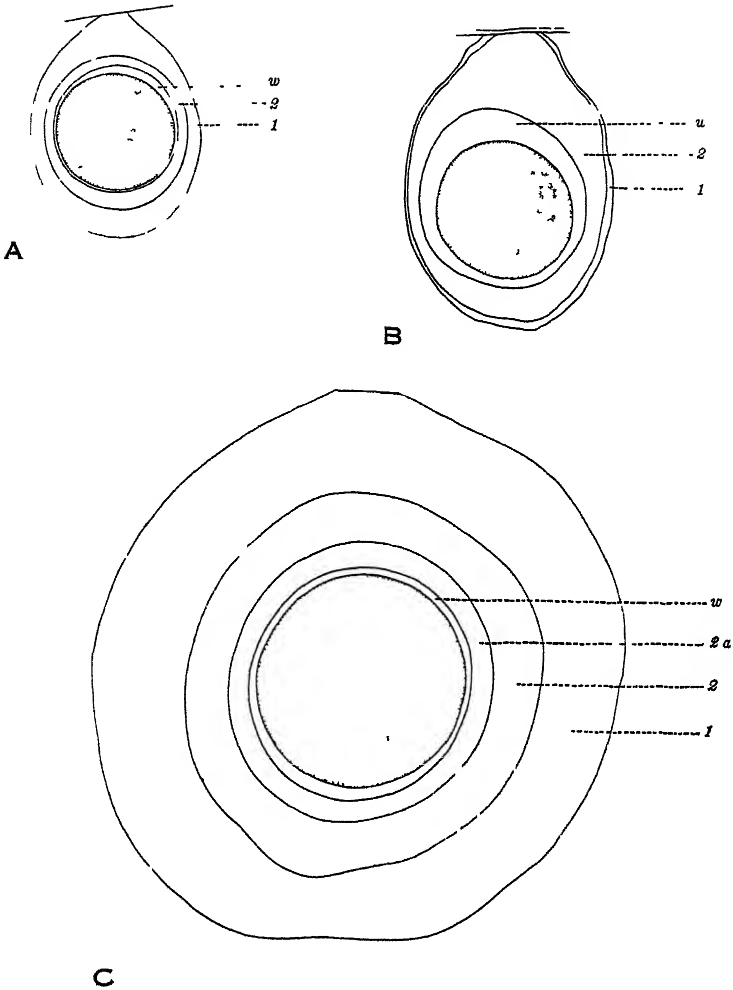


Fig. 3. A, Egg of *Stereochilus marginatum* (Hallowell). The outer capsule is elongated to form a slight stalk. Fixed in formalin. ×7½.

B, Egg of *Eurycea bislineata bislineata* (Green). Fixed in formalin. ×7½.

C, Egg of *Gyrinophilus porphyriticus* (Green). Fixed in formalin. ×7½.

1, Outer capsule; 2, inner capsule; 2*a*, second inner capsule; *w*, fluid space.

The Eggs of *Stereochilus* and Other Plethodontids

The eggs of *Stereochilus* as described above differ from those of *Eurycea bislineata* in having little or no stalk. On the average they are a little more than twice as numerous, although the adult female *Stereochilus*

is only slightly larger than the adult female *Eurycea bislineata.* Correlated with this greater number, the eggs of *Stereochilus* are slightly smaller than those of *E. bislineata.* A more fundamental difference is to be found in the egg-capsules. Both *Stereochilus* and *Eurycea bislineata* have two egg-capsules surrounding a space filled with fluid. The egg covered by its very thin vitelline membrane floats in this space which under a lens might be mistaken for a capsule. The space is very much larger in *E. bislineata* than in *Stereochilus,* but in both the fluid is under such pressure that when a hole is made in the two outer capsules the egg, covered by its thin vitelline membrane, is forced out with strength enough to cause it to become ruptured.

An important difference between the eggs of *Stereochilus* and those of *E. bislineata* is to be found in the two outer capsules. In *Stereochilus* the outermost is thick, soft, and adhesive. In *E. bislineata* the outer capsule is very thin (Fig. 3B). The second, or inner capsule, is thin and very resistent in *Stereochilus,* while in *E. bislineata* it is thick and takes part in the formation of the stalk. The outer capsule of an egg of *Stereochilus* attached to a stone might become elongated to form a slight stalk (Fig. 3A), although this is not the rule (Fig. 4). The relative thickness of the capsules and their relation to the point of attachment will readily serve to distinguish any *Stereochilus* egg from that of *E. bislineata.* An average of five eggs of *Stereochilus* preserved in formalin compared with five preserved eggs of *E. bislineata* is as follows:

	Diameter of Egg	Diameter of Inner Capsule	Diameter of Outer Capsule
Stereochilus	2.25 mm. (2.5 max. 2.0 min.)	2.64 mm. (3.0 max. 2.5 min.)	3.1 mm. (3.5 max. 3.0 min.)
E. bislineata	2.60 mm. (2.75 max. 2.5 min.)	2.95 mm. (3.25 max. 2.5 min.)	3.8 mm. (4.5 max. 3.5 min.)

Stereochilus, in the retention of the parasphenoid teeth patches in a line continuous with the vomerine series, is one of the most primitive plethodontids. A comparison of its eggs with those of *Gyrinophilus,* the most primitive living plethodontid, should, therefore, be of interest. No egg-capsules of any species of *Gyrinophilus* have been described in detail. On March 6, by implanting a large female *G. porphyriticus* with three anterior pituitaries of *Rana pipiens,* we induced her to lay. The first seventeen eggs were laid on moss, before the salamander was transferred to a crystallizing dish provided with a stone bridge. On March 7, forty-six additional eggs were laid: twelve attached singly to the under side of a stone, eight attached to the edges of the same, and twenty-six were loose on the bottom (possibly some of these had been detached after

laying). On March 9, eighteen more eggs were laid: nine on edge of rock, one on its under surface, and eight, when found, were loose on the bottom of the dish. A feature of special interest was the high percentage of "fused eggs." Ten of the eggs were in pairs enclosed in one or two capsules in common, and three formed a single group surrounded by

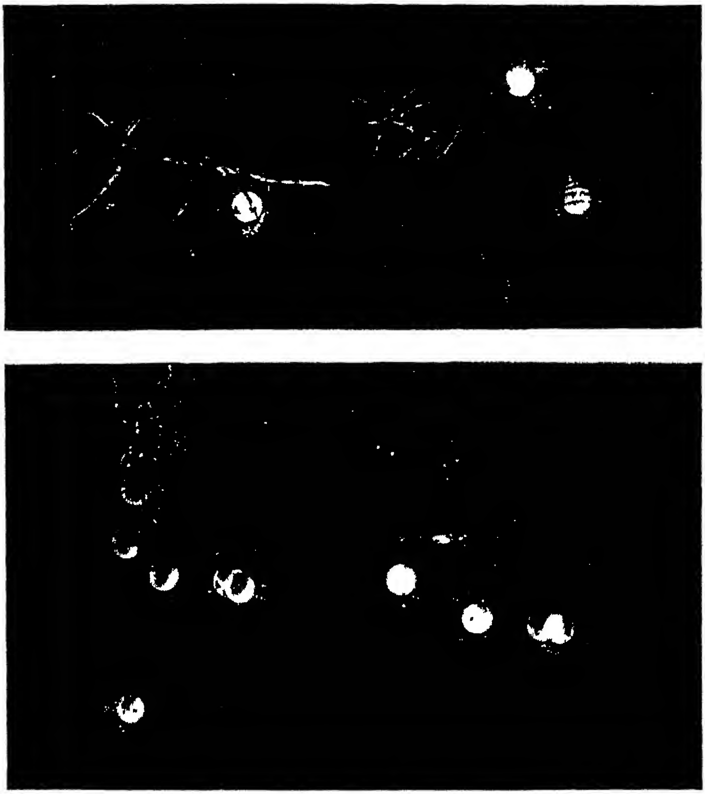


Fig. 4. Eggs of *Stereochilus marginatum* (Hallowell). Attached to stone and water-weed. Photographed a few hours after having been laid. ×2

a common outer capsule. Thus, this female laid ninety-three eggs in all. In spite of the fact that the adpressed surfaces of these eggs were considerably flattened, most of the double eggs developed to the neural plate stage, when one of each pair invariably died.

The eggs of *Gyrinophilus porphyriticus* agree with those of *Stereochilus* in lacking a definite stalk and in having a relatively thick, soft and adhesive outer capsule. The fluid-filled space is comparatively

narrow as in *Stereochilus*. The outer capsule is more irregular than in that genus. The most distinctive difference between the eggs of *Gyrinophilus* and those of *Stereochilus* is to be found in the inner capsules. In *Stereochilus* the second or inner capsule has a thin, slightly opaque inner surface. In *Gyrinophilus* this lining membrane, if such it may be called, is swollen to form a distinct capsule. There is thus one more capsule in *Gyrinophilus porphyriticus* than in *Stereochilus*, but otherwise the egg-capsules are in close agreement (Fig. 3, A and C).

The eggs of *Gyrinophilus porphyriticus* are much larger than those of *Stereochilus*. The average dimensions of six eggs of the former are as follows:

Diameter of Egg	Diameter of Capsule 2A	Diameter of Capsule 2	Diameter of Capsule 1
3.8 mm. (4.0 max. 3.5 min.)	4.81 mm. (5.25 max. 4.25 min.)	6.5 mm. (7.00 max. 5.5 min.)	8.6 mm. (9.0 max. 7.5 min.)

It may be noted that the dimensions of living eggs and those preserved in formalin are not the same. In the case of the present species the capsules have slightly swollen in formalin. The above dimensions are of eggs that had been in formalin for five days. The same eggs were measured a few hours after they were laid and before they were put into formalin and the relative proportions have changed only slightly, the living eggs averaging 3.5 mm., 4.3 mm., 4.9 mm., and 6.2 mm., for the same parts as are listed above.

The Egg-Laying of Sirenids

Siren and *Pseudobranchus* are of especial interest to students of amphibian phylogeny for they are the only living representatives of a distinct suborder of salamanders, Meantes. No details were known concerning the eggs of either *Siren* or *Pseudobranchus* until recently, when one of us published a note concerning the eggs of the latter (Noble, 1930). Since then, February 1931, we received a series of *Pseudobranchus* from Mr. J. S. Alexander from Gainesville, Florida. By using pituitary implants we have found no difficulty in making ten of the largest females deposit eggs in crystallizing dishes half full of water and provided with abundant water-weed. The eggs are laid singly or in small groups. Each is provided with a thick, opaque, outer capsule which is very adhesive and usually forms a broad attachment to the bottom of the dish or to the more resistent weed. Closely adherent to the outer capsule is a transparent, much firmer, less adhesive inner capsule. An examination of a series of the eggs preserved in formalin

has shown that this inner capsule which appears single in the fresh egg and was originally described as such is, in fact, duplex. Its inner portion is more resistent than the outer and the two parts may be distinguished with proper illumination of the preserved capsules. The inner capsule is separated from the egg and its closely adherent vitelline membrane by a wide fluid-filled space. The egg is very soft and when a small hole is made in the capsules the egg is driven out by the pressure of the intra-capsular fluid. Although more than half the egg can go through a hole only a fraction of its diameter, the remainder usually ruptures before the egg is entirely free.

The eggs of *Pseudobranchus* undergo less change than the plethodontid eggs described above when fixed in the same strength formalin. Probably this is due to the resistent inner capsule and the large fluid-filled space around the egg. Five fresh eggs average as follows:

Diameter of Egg	Diameter of Inner Capsule	Diameter of Middle Capsule	Diameter of Outer Capsule
2.55 mm. (2.75 max.) 2.5 min.)	3 mm.	4.2 mm. (4.5 max. 4.0 min.)	5.6 mm. (6.0 max. 5.5 min.)

By way of comparison: an average egg fixed in formalin measures 2.6 mm., 3.1 mm., 4.1 mm., and 5.2 mm. for the same parts (Fig. 5A).

We experienced considerable difficulty in rearing the eggs of *Pseudobranchus*. Fertilization is apparently external in the Sirenidæ. Although we implanted males we never witnessed any sexual activity. Nevertheless, several of the eggs cleaved and one developed into a normal larva. Finally, in order to secure developmental material, we resorted to removing the eggs from the oviduct and artificially fertilizing them. A discussion of this material is reserved for a later report.

Having been successful in securing normal eggs of *Pseudobranchus* we were interested to compare these with those of *Siren*. We were fortunate in receiving, early in February 1931, a series of *Siren* from Mr. J. S. Alexander. Over the week-end of February 16, eight eggs were found in a large tank containing seventeen adult sirens. By isolating the larger specimens in different tanks we finally determined the female which was laying the eggs. The next day four more eggs were laid. Twenty eggs were laid the following day and nineteen more by February 21.

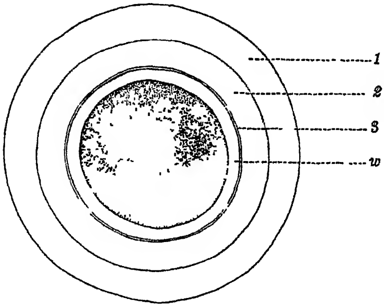
Since none of these eggs were apparently fertilized, although many were left in the tank with a large number of adults, we decided on February 25 to sacrifice the female and attempt artificial fertilization. The latter procedure presented some difficulties, since no external sexual

difference is known in this species, and we could not be sure of the sex without dissection. Considering the possibility that the male would have a broad tail-fin, we selected the broadest tailed adult in the collection. Dissection revealed that this was a female. Our second choice, a narrow-tailed adult, proved to be a male. With this freshly prepared male we proceeded with the assistance of Mrs. E. R. Mason to examine the *Siren* which had been laying the eggs for several days previously.

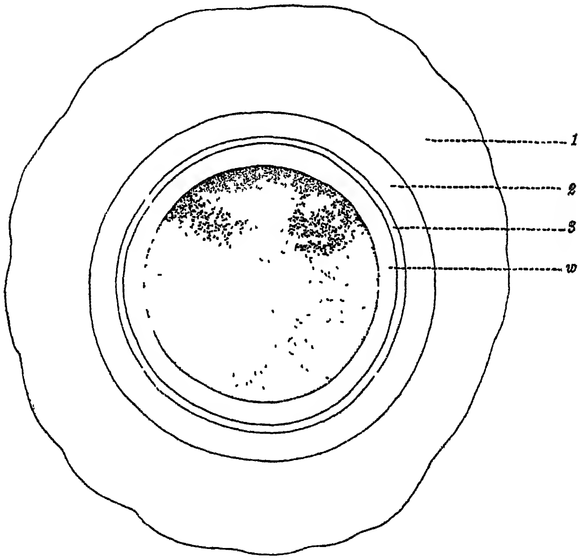
When the female was opened the right oviduct was found to be greatly distended and no less than 265 eggs were removed from its caudal end. Many of these were swollen and all but fifty exhibited some creases or furrows on the surface of the egg proper. These furrowed eggs were placed in large dishes of water, but in no case did development proceed to gastrulation. The furrowing was so irregular that it appears extremely doubtful that this was a typical development.

The fifty eggs showing no evidence of cleavage, if such the furrowing may be called, were artificially fertilized by a sperm suspension made from the testis of the other *Siren*. None of these eggs developed normally or passed beyond gastrulation although many underwent some cleavage. Some of the furrowed eggs removed from the oviducts were preserved and sections of these may show whether or not fertilization had occurred. Since the eggs removed from the oviduct had the same number of capsules as those laid in the tank the capsules must be secreted by the more anterior portions of the oviduct.

The first eggs laid in the tank showed no evidence of furrows and we may assume these are normal, even though unfertilized, eggs. It was interesting to find how closely they agreed with the eggs of *Pseudobranchus*. Three egg-capsules were plainly visible even before fixation. The outer is opaque whitish in color, becoming whiter in time. The middle is much thinner than the outer. It is translucent and closely adherent to the latter. In dissecting out the egg the outer capsule may be separated only with difficulty from the middle. In striking contrast the middle capsule of the fresh egg does not adhere to the inner. When only a small section of the middle capsule has been cut the egg, surrounded by the inner capsule, slips out. In some of the fresh eggs a narrow fluid-filled space was found immediately surrounding the inner capsule. This is not demonstrable in eggs preserved in formalin and is not shown in the drawing (Fig. 5B). The inner capsule is much thinner than the middle but more resistent. Its firmness is due in part to the fluid surrounding the egg being under considerable pressure. A small hole made in the inner capsule releases the pressure but the egg forced



A



B

Fig. 5. Sirenid eggs. Fixed in formalin. ×7½.
A, *Pseudobranchus striatus* (Le Conte).
B, *Siren lacertina* Linné.
1, Outer capsule; 2, middle capsule; 3, inner capsule: *w*, fluid space.

into the opening usually bursts before the capsule may be opened wide enough to permit the egg's escape.

The eggs of *Siren* agree with those of *Pseudobranchus* in having the upper third or two-fifths heavily pigmented with brown. The polar bodies of *Siren* lie eccentrically in the pigmented cap and usually in a very small densely pigmented depression. The periphery of the pig-

mented cap of *Siren* is darker than the central portion. In some eggs the latter may be only a little darker than the vegetative pole.

To summarize, it may be noted that, while the eggs of *Siren* differ from those of *Pseudobranchus* in their larger size and unequally pigmented animal pole, they agree in all other essential particulars. In both: (1) the eggs are laid singly or in small groups; (2) the outer capsule is opaque and very adherent; (3) the middle capsule is translucent, adherent to outer capsule but free from an inner capsule; and (4) this thin inner capsule is well raised from the egg (and its vitelline membrane) by a fluid which is under considerable pressure.

In the above description we have compared the eggs of *Siren* and *Pseudobranchus* received from Florida. It is usually assumed that these two genera are represented by only a single species each. There is considerable evidence that the Arkansas *Siren* is referable to a distinct species. The egg-capsules of this western *Siren* do not agree in full detail with those of the Florida form. These differences will be discussed in the paper dealing with the description of the Arkansas material.

The Egg-Laying of *Rhyacotriton olympicus*

The family Ambystomidæ includes only three genera of salamanders: *Ambystoma, Dicamptodon* and *Rhyacotriton.* The Asiatic land salamanders, *Hynobius* and its allies, are not ambystomids as frequently stated but comprise a well-defined family, the Hynobiidæ (Cope, 1889; Dunn, 1923). Within the Ambystomidæ there appear to be two natural groups of genera, for *Dicamptodon* and *Rhyacotriton* are characterized by a lacrymal bone which is lacking in *Ambystoma.* The eggs of *Dicamp todon,* as shown by Storer (1925). differ remarkably from those of any species of *Ambystoma* so far as known and the question arose would the eggs of *Rhyacotriton* agree with those of *Dicamptodon.* Structurally *Rhyacotriton* appears to be a dwarf derivative of *Dicamptodon* but the question remained as to how far the life-history data gave evidence of this relationship.

Fortunately, Mr. Phillips G. Putnam was collecting *Ascaphus truei* in the Olympic Mountains Washington, at the time we began this study and we urged him to collect gravid *Rhyacotriton* alive for us and to observe any details of life history which might be worked out in the field. Mr. Putnam collected in the Lake Cushman area from June 5 to September 9, 1930, and shipped, in chests partly filled with broken ice, a large series of living specimens. These were transferred to an ice box where they were available for the experimental work.

We began our experiments at once without waiting for Mr. Putnam's field notes, but his more significant observations may be recorded first since they have an important bearing on our findings. On June 5, in one of the small streams near Lake Cushman, *Rhyacotriton olympicus* was apparently paired. At least individuals of opposite sex were found together and the ovaries and testes appeared to be in a breeding condition. On June 7, in Elk Creek, a single egg was found attached to a tendril on the under side of a stone, and it was assumed to have been laid by *Rhyacotriton*. Another pair of *Rhyacotriton* was found together June 11 in Triple Trip Creek where the water temperature was 10° C. and the air temperature 14° C. Larvæ of *Rhyacotriton* were also collected in this stream. Paired *Rhyacotriton* were found in Madeline Creek on June 24 and Mr. Putnam writes in his field book under this date:

> In one section of Madeline Creek about one half mile above the trail junction the creek passes through a broken gorge with perpendicular walls up to 30 ft. in height. Here, little sunlight filters through and the spray from numerous waterfalls gives the effect of a constant drizzle. In this area I found *Rhyacotriton* numerous, especially in the cave-like recesses beneath large rocks. Here sometimes as many as eight *Rhyacotriton* would be seen together on a single mossy stone. They are very alert and most of them would plunge into the foaming water to escape.

Subsequent observation confirmed the conclusion that *Rhyacotriton* prefers those portions of the stream that are overhung by cliffs or trees and where little light penetrates. Mr. Putnam returned to Madeline Creek on July 6 and after considerable search found a single egg which he again assumed to have been laid by a *Rhyacotriton*. His previous dissection of gravid females had led him to conclude that a single individual must lay very few eggs and he writes in the field:

> The *Rhyacotriton* eggs are apparently deposited singly beneath stones and are without conspicuous gelatinous capsules. An adult *Rhyacotriton* deposits approximately only twelve eggs which are naturally difficult to find.

Subsequent search in this and many other creeks in the Lake Cushman area failed to disclose any additional eggs. No paired adults were seen again although a large series of adults and larvæ were collected. The two eggs secured by Mr. Putnam were destroyed in transit and no further notes concerning them were made. It is therefore fortunate that, due to Mr. Putnam's ingenuity, gravid specimens reached New York in good condition. For two evenings we allowed the adults of both sexes to wander about a tank supplied with running, iced water. Flat stones were added and the temperature of the water slowly raised and lowered. Although all observations were made at night with the aid of a red light, no definite courtship behavior was noted and no eggs were laid.

We, therefore, turned to the pituitary technique as a means of inducing ovulation.

On June 27, 1930, six gravid females and four adult males were implanted with anterior pituitary tissue secured from local *Desmognathus fuscus*, *Eurycea bislineata*, and *Rana catesbeiana*. The specimens were then returned to the tank mentioned above. The tank was provided with flat stones and the water cooled with ice to 6° C. The water was then allowed to warm to 16° C. Because of an intense heat wave the temperature was difficult to regulate in the tank and the specimens were transferred to a series of crystallizing dishes in the ice box. Here an approximate temperature of 7° C. was maintained and the dishes were provided with flat stones arranged as in the case of the *Eurycea bislineata* experiments reported above. On July 14, after eleven implants, one female laid. On the following day three others laid. The eggs were attached to the sides and upper surfaces of the rocks. On July 24, eight more females were implanted. After eleven implants, one laid. The remaining seven failed to lay even after thirty implants. The average number of eggs laid by the five females was five, the maximum number eight and the minimum number three.

From these experiments it would follow that five is the average number of eggs laid by *Rhyacotriton olympicus*. An examination of the ovaries of a female preserved in formalin in the field in 1922 shows four well-developed eggs in one ovary, and three in the other. The ovaries of a gravid female preserved in the field in 1930 show five eggs in all.

The egg of *Rhyacotriton olympicus* is large and pigmentless. Although a breeding female measures only 87 mm. in total length, the formalin-fixed eggs average 4.5 mm. in diameter, without the capsules. In the living egg there appear to be three capsules: a soft, gelatinous inner capsule, a firmer, more opaque middle capsule, and a thick transparent outer capsule. In the egg preserved in formalin (Fig. 6) the inner capsule is opaque and the middle capsule swollen. In the fresh egg the middle capsule is so thin that it might be considered merely a membrane covering the inner capsule. In the preserved egg the middle capsule is very distinct. For a few hours after laying the outer capsule exhibited a series of fine ridges. By the time the two-celled stage was reached these ridges had entirely disappeared.

By combining Mr. Putnam's field observations with the above description we may conclude that *Rhyacotriton* lays its eggs singly under or between stones in mountain streams. The eggs are very large, unpigmented and provided with three capsules. *Rhyacotriton* differs from

Dicamptodon in laying fewer eggs of very large size (as compared with the smaller body-size). There is also a difference in the mode of attachment of the eggs, *Dicamptodon* depositing its eggs in groups instead of singly. The eggs of the two species differ in that *Dicamptodon* has one instead of three capsules.

Small Amphibia usually lay fewer eggs than their larger relatives (Noble, 1927). The newts primitively laid their eggs in groups as in the case of *Pleurodeles waltl,* but many derived species such as *T. viridescens* lay their eggs singly. Hence the most important divergence of *Rhyacotriton* from *Dicamptodon* lies in the egg-capsules. In view of observations on the egg-capsules of the plethodontids and sirenids described above this difference would appear to be a fundamental one. The increase in the number of capsules is an approach to the condition in *Ambystoma.*

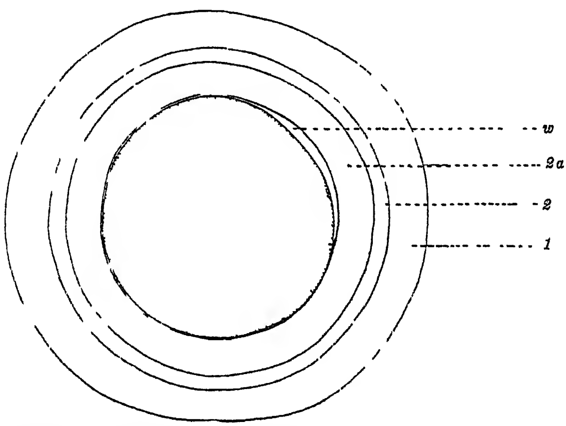


Fig. 6. Egg of *Rhyacotriton olympicus* (Gaige). Fixed in formalin. ×7½.
1, Outer capsule; 2, middle capsule; 2*a*, inner capsule; *w*, fluid space.

Experiments with *Ambystoma opacum*

From the above experiments it appears that implanting fresh anterior pituitary substance will induce salamanders to lay their eggs provided these have reached a certain stage of maturity. Although we implanted male *Gyrinophilus porphyriticus, Eurycea bislineata,* and *Rhyacotriton olympicus* in the same way as the females for extended periods, in not a single case did we obtain spermatophores which could be attributed to the treatment. This negative result could not be due to the fact that the breeding season was past and that sperm were no longer in the ducts. Several of the *Eurycea* and *Gyrinophilus* treated were

individuals which were actively courting before we began the treatment. Houssay, Giusti and Gonzalez (1929) noted that the male toad required more implants than the female to induce sexual activity. Apparently male salamanders are even less sensitive than toads to the implants. The question should be tested by carefully planned experiments.

There is another question regarding the gonad stimulating influence of the anterior pituitary which the above experiments did not consider. Although implants of fresh anterior pituitary substance will induce a release of the eggs from the ovary several months before the normal season, the question remained as to what influence, if any, the pituitary implants would have in building up a spent ovary. Information in this direction might prove of practical value to the student who wished to obtain the maximum number of eggs from a limited number of females.

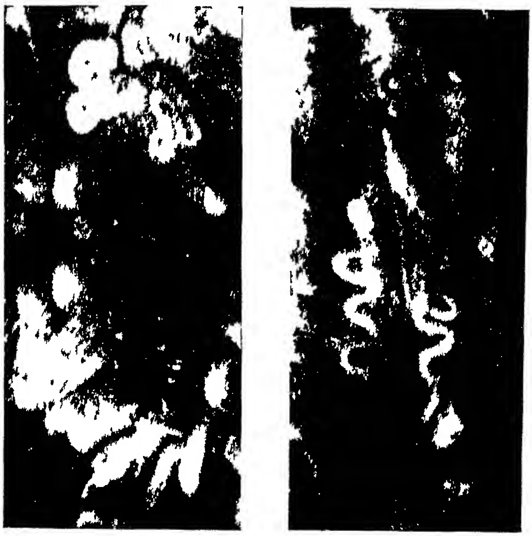
Ambystoma opacum appeared to be a favorable species for experimentation in this field, because the females after laying their eggs on land in the fall remain with them. Noble and Brady (in manuscript) have shown by dissection that brooding females are invariably spent.

In October 1929, a series of brooding *Ambystoma opacum* collected by Noble and Brady were set aside for experimentation. Four of the females were implanted with fresh anterior pituitary substance taken from a variety of salamanders and frogs. The implants were made approximately every other day. Two other females were implanted the same day with muscle. Each salamander was maintained in a separate crystallizing dish and adequately provided with moss and damp leaves. In order to be sure that both experimentals and controls secured the same amount of food, all the salamanders were force-fed on raw beef.

The salamanders did not stand the treatment well and eventually mold appeared on most of them. On March 27 one female, which had received twenty-nine implants and had been edematous for several weeks, died from the mold. On May 5 another female which had received thirty-nine implants died and one of the muscle-implanted controls was sacrified and preserved for comparison. The difference between the ovaries and oviducts of the second experimental and those of its control was very marked. The oviducts of the control specimen were less than a fifth as wide as those of the experimental and not nearly as convoluted. The ova were uniformly about .5 mm. in diameter, while the diameter of many of those of the experimental animal were from 1.5 mm. to 2 mm.

On May 6 and 7 the remaining salamanders of the series were sacrificed since forty implants had been given and none of the females appeared to be in a breeding condition. Again a very marked difference in

the ovaries and associated ducts of the experimental specimens when compared with those of the control was noted. This difference is well shown in the photographs of one of the pituitary implanted females (Fig. 7, A and B), killed on May 7, and its control specimen. The oviducts, measured at the most posterior convolution, are twice as wide in the experimental as in the control and the ova of the pituitary implanted specimen measure from 1.5 to 2 mm. in diameter in contrast to those of the muscle-implanted control, which measure .5 mm. in diameter.



A B

Fig. 7. A, Ovaries and oviducts of *Ambystoma opacum* (Gravenhorst) implanted with anterior pituitary ×2

B, Control specimen implanted with muscle. ×2

It is clear from the above experiments that anterior pituitary implants will build up the ovaries and hypertrophy the oviducts of a spent *Ambystoma opacum*. We did not succeed in inducing salamanders which had laid in the fall to lay again in the spring This may have been due to the frequent infections of mold. It is possible that we did not implant enough pituitary substance at any one time. Judging from our experience with other salamanders, large frog pituitaries might have brought quicker results.

CONCLUSIONS

1.—*Eurycea bislineata bislineata* may be induced by fresh anterior pituitary implants to lay its eggs several months before the normal season. The eggs are attached to the under side of stones in the usual manner and develop normally.

2.—During oviposition the female may leave the breeding rock but she returns to continue laying in the immediate vicinity of the first-laid eggs.

3.—Although *Eurycea bislineata cirrigera* attaches its eggs singly in irregular groups to water-weed in its native habitat, it will attach them to the under side of stones in the manner of *E. b. bislineata* when it is given a choice between submerged water-weed or stones. The egg-capsules may show some variation but usually resemble those of *E. b. bislineata* closely.

4.—Implanted *Stereochilus marginatum* will lay its eggs under a variety of conditions, but the aquatic habitat appears to be the normal situation. When ovipositing in the water the female turns upside down. This appears to be the retention of the habits of mountain-brook ancestors which presumably attached their eggs to the under side of stones.

5.—The eggs of *Stereochilus* resemble those of *Eurycea bislineata* but are smaller, more numerous and lack stalks. They resemble those of *Gyrinophilus porphyriticus* most closely although these are larger and have an additional capsule.

6.—The eggs of *Pseudobranchus striatus* and *Siren lacertina* laid in the laboratory agree closely and differ from those of all other salamanders. The eggs are pigmented, laid singly or in small groups, and are provided with an opaque, adherent outer capsule, a translucent middle capsule, and a thin inner capsule separated by a wide fluid-space from the egg with its tightly fitting vitelline membrane.

7.—*Rhyacotriton olympicus* induced to lay in the laboratory by pituitary implants deposits on the average five eggs and this may be considered the average number of eggs for the species in nature. The eggs are large, unpigmented, and have three capsules. In nature *R. olympicus* breeds during June and July and attaches its eggs singly beneath stones in cold mountain-streams.

8.—Pituitary implants will build up the ovaries of a spent female salamander. A marked increase in size of both the ovaries and oviducts in spent *Ambystoma opacum* was obtained by pituitary implants.

LITERATURE CITED

Brimley, C. S. 1923. 'The Dwarf Salamander at Raleigh, N. C.' Copeia, No. 120.

Cope, E. D. 1889. 'Batrachia of North America.' Bull. U. S. Nat. Mus., No. 34.

Dunn, E. D. 1923. 'The Salamanders of the Family Hynobiidæ.' Proc. Amer. Acad. Arts and Sci., LVIII, No. 13.

1926. 'The Salamanders of the Family Plethodontidæ.' Northampton, Mass. 1926.

Houssay, B. A., Giusti, L., and Lascano-Gonzalez, J. M. 1929. 'Hypophysentransplantation und sexuelle Reizung bei der Kröte.' Rev. Soc. Argent. Biol., V, pp. 397–418.

NOBLE, G. K. 1927. 'The Value of Life History Data in the Study of the Evolution of the Amphibia.' Ann. N. Y. Acad. Sci., XXX, pp. 31–128.

1930. 'Probing Life's Mysteries.' Nat. Hist., XXX, No. 5.

1930. 'The Eggs of *Pseudobranchus*.' Copeia, No. 2.

NOBLE, G. K., AND RICHARDS, L. B. 1930. 'The Induction of Egg-laying in the Salamander, *Eurycea bislineata*, by Pituitary Transplants.' Amer. Mus. Novitates, No. 396.

STORER, T. I. 1925. 'A Synopsis of the Amphibia of California.' U. of Calif., Publ. Zool., XXVII.

AMERICAN MUSEUM NOVITATES

Number 514 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Jan. 30, 1932

56.8, 4G (1183:54.4)

A NEW SPECIES OF FOSSIL GAVIAL FROM THE SIWALIK BEDS[1]

BY CHARLES C. MOOK

Among the fossil vertebrates collected by Barnum Brown from the sediments of the Siwalik formation in 1922, is a well-preserved gavialoid crocodilian skull. This skull is practically complete, except for the premaxillary region, which is missing. Its horizon is lower middle Siwalik, which makes it Lower Pliocene, according to Dr. Matthew's 1929 correlation (p. 441, fig. 1). Ten teeth are preserved, and the alveoli of nearly all of the rest in the portion of the skull preserved are clearly indicated. The locality is one mile south of Nathot, India.

The characters of this skull indicate that it belonged to a species quite distinct from the living gavial of the Gangetic region (*Gavialis gangeticus*), from the various Siwalik species of gavials described by Falconer, Cautley, and Pilgrim, and from *G. dixoni* Owen, of the Eocene of Europe. Comparison with *G. bahiensis* Marsh is not possible at the present time. This species is given the name *Gavialis browni* in honor of Mr. Brown, who collected the type skull.

Gavialis browni, new species

TYPE.—Amer. Mus. 6279. Skull with ten teeth, practically complete except for the premaxillary region, which is missing

TYPE LOCALITY AND LEVEL.—One mile south of Nathot, India. Lower part of the middle Siwalik beds. Lower Pliocene.

TYPE CHARACTERS.—Skull gavialoid but more massive in construction than is usual in *Gavialis*. Teeth relatively strong and far apart. Palatine fenestræ long and narrow. Orbits relatively close together. Supratemporal fenestræ broad in proportion to their length. Supraoccipital bone does not appear on dorsal surface of skull. Nasal bones relatively long and narrow.

DESCRIPTION.—The sutures on the superior surface of the skull are fairly clear. The prefrontals occupy relatively less of the orbital border in this species than they do in the modern gavial, and the lachrymal has a relatively longer contact with the nasals. Ten alveoli lie opposite or posterior to the anterior end of the nasals on each side. In the skull of living *G. gangeticus* compared (of about the same size) there are eleven. The nasal bones are narrower in the fossil form, *G. browni*.

On the palate the maxillo-palatine sutures are obscure, but they appear to extend farther forward than in the living gavial. In the latter, *G. gangeticus*, the distance

[1]Contributions to the Osteology, Affinities, and Distribution of the Crocodilia. No. 23.

Fig. 1. *Gavialis brouni*, new species. Type, Amer. Mus. No. 6279. Skull. One-fifth natural size.

A, lateral view, right side, B, superior view

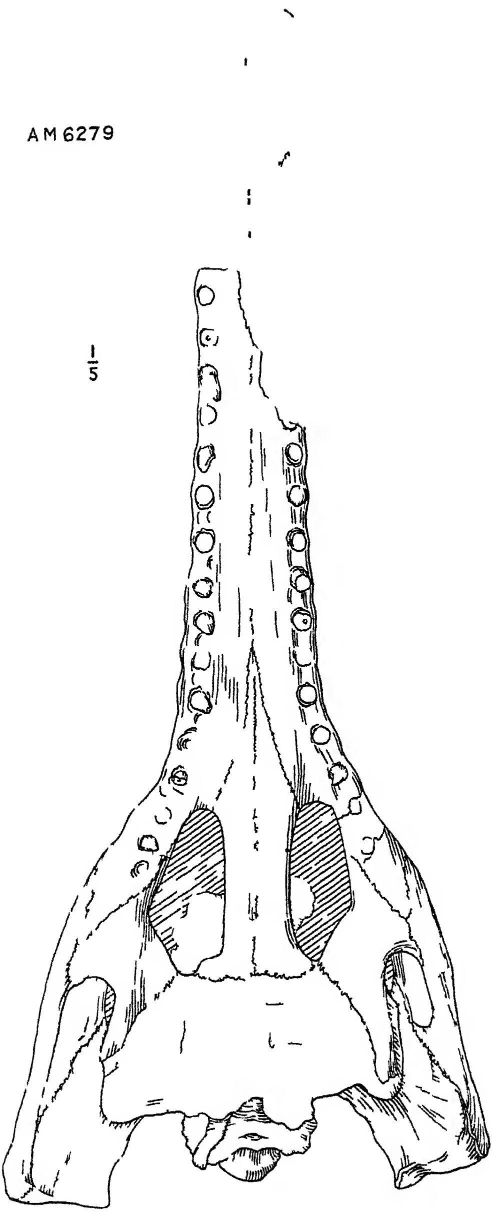


Fig 2 *Gavialis browni* new species Type, Amer Mus No 6279 Skull One-fifth natural size.
Inferior view

from the anterior ends of the palatine fenestræ forward to the junction of the two maxillo-palatine sutures at the median line, measured along the median line, is considerably less than the breadth of the palate at this junction. In *G. browni* this distance along the median line is considerably greater than the breadth of the palate.

The palatine fenestræ of the fossil specimen, *G. browni*, are much longer, and relatively much narrower than in the living gavial. In the fossil specimen the length of either fenestra is about one and one-third times the length of the pterygoids. In *G. gangeticus* the fenestræ are equal in length to the pterygoids.

Fossil gavial specimens from the Siwalik formation have been described by Falconer and Cautley as *Gavialis leptodus* and *Rhamphosuchus crassidens*, and by Lydekker and Pilgrim as *Gavialis hysudricus*, *G. curvirostris*, *G. pachyrhynchus*, *G. curvirostris* var. *gajensis*, and *G. breviceps*. The new species, *G. browni*, has been compared with figures of all these and differs from all except *R. crassidens* in having the teeth, or their alveoli, farther apart in proportion to the breadth of the snout. It is difficult to make a satisfactory comparison with *R. crassidens*, as few corresponding parts are preserved in the type, and those that are so preserved are not especially significant. It appears that in *R. crassidens* the snout is deeper vertically, also its horizon is somewhat higher than in the new species.

In *Gavialis dixoni* Owen, from the Eocene of England, the snout is narrower, and the alveoli are spaced farther apart than in the new Siwalik species. The latter is almost intermediate in this respect between *G. dixoni* on the one hand and the previously described Siwalik gavials on the other.

CONCLUSIONS

This new species, *Gavialis browni*, represents a previously unknown stage in the evolution of the gavials. The direction of specialization in the gavials has been to increase the length of the snout, to multiply the number of teeth, to decrease the size of the teeth, and to bring them closer together. *G. dixoni* represents a primitive stage in this process, *G. browni* a slightly more advanced stage; the species of gavials described by Falconer and Cautley, and by Lydekker represent highly specialized stages, and the modern gavial is the culminating stage. Opinion as to the exact phylogenetic relations of the various species of gavials is reserved for the present.

BIBLIOGRAPHY

FALCONER, H., AND CAUTLEY, P. T. 1840. 'Notice on the Remains of a Fossil Monkey from the Tertiary Strata of the Siwalik Hills in the North of Hindustan.' Trans. Geol. Soc. London, Ser. 2, V, p. 503. (Original description of *Rhamphosuchus crassidens* as *Leptorhynchus crassidens.*)

CAUTLEY, P. T. 1868. 'Appendix to the Memoir on Crocodiles.' Falconer's Palæontological Memoirs, I, p. 355. Pl. XXIX, fig. 4. (Original description of *Gavialis leptodus.*)

LYDEKKER, RICHARD. 1886. 'Siwalik Crocodilia, Lacertilia, and Ophidia.' Mem. Geol. Surv. India, Palæontologia Indica, Ser. 10, III, pp. 222–224, Pl. XXXII, figs. 1, 1*a*, 1*b*, 1*c*, 2, 2*a*, 2*b*, 2*c*, 4. (Original description of *G. hysudricus*, *G. curvirostris*, and *G. pachyrhynchus.*)

LYDEKKER, RICHARD. 1888. 'Catalogue of the Fossil Reptilia and Amphibia in the British Museum.' Part I, pp. 68–69. (Descriptions of various gavials.)

MATTHEW, W. D. 1929. 'Critical Observations Upon Siwalik Mammals.' Bull. Amer. Mus. Nat. Hist., LVI, Art 7, pp. 437–560.

PILGRIM, GUY E. 1912. 'The Vertebrate Fauna of the Gaj Series in the Bugti Hills and the Punjab.' Mem. Geol. Surv. India. N.S., IV, No. 2, pp. 80–82. (Original descriptions of *G. curvirostris* var. *gajensis* and *G. breviceps.*)

AMERICAN MUSEUM NOVITATES

Number 515 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Jan. 30, 1932

59.7,55 N (67.5)

A LARGE *NOTOPTERUS* FROM LUKOLELA, CONGO RIVER

BY J. T. NICHOLS AND F. R. LAMONTE

In a small collection of fishes obtained at Lukolela on the Congo River (roughly 500 miles from its mouth) in 1931 by Dr. James P. Chapin, there is a fine specimen of *Notopterus*, 355 mm. in length to base of caudal, which differs in several respects from the type specimen of *Notopterus afer* Günther figured by Boulenger (1909, 'Fresh-water Fishes of Africa,' I, p. 146). It seems to agree closely with the photograph of a large *Notopterus* in Bull. Agric. Congo Belge, XX, No. 3, p. 321, 1929, from Eala, about 110 miles farther upriver. *Notopterus afer*

Fig. 1. *Notopterus afer congoensis*, type.

is rare in collections, and we have been unable to obtain a comparably large specimen for comparison with our Lukolela fish. The type figured by Boulenger was about 240 mm. in standard length, and a specimen of about 153 mm. from Nanna Kru, Liberia, which we have for comparison through the courtesy of Mr. J. R. Norman of the British Museum, agrees with it in those particulars wherein our larger specimen differs:

Maxillary to under middle of eye (in this Lukolela fish) instead of to, or almost to, the posterior border of eye; pectoral extending past front of anal for the last third of its length, instead of reaching or falling short of anal origin. Ground color pale, showing narrowly between irregular rounded or oval dark spots which coalesce more or less into vertical stripes, instead of ground color dark with pale markings.

We publish herewith a photograph of the specimen from Lukolela, Number 9697 American Museum of Natural History, which may provi-

sionally stand as the type of a new race, **Notopterus afer congoensis.** Its measurements follow.

Length to base of caudal, 355 mm.; depth in this length, 4.7; head, 5.1; eye in head, 6.5; snout, 4.7; interorbital, 4.2; maxillary, 2.7. Width of body, 2. Pectoral, 1.5. Greatest height of anal fin, 2.2; of dorsal fin, 2.2. Dorsal 5; anal (including caudal) about 120. Scales about 175; 32–33 scutes in abdominal ridges. Gill-rakers (on lower limb of first arch), 8.

AMERICAN MUSEUM NOVITATES

Number 516 | Published by The American Museum of Natural History New York City | Feb. 17, 1932

59.88, 1 M (96)

BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION, XVIII[1]

NOTES ON MELIPHAGIDÆ FROM POLYNESIA AND THE SOLOMON ISLANDS

By Ernst Mayr

In order to understand the relationships and zoögeographical position of several species of honeysuckers from the Solomon Islands, I have undertaken a revision of all the Polynesian and Melanesian species of the family. Like every other reviser of this group, I have been confronted by two difficulties: the indistinctness of the color characters in most forms, and the unreliability of structural characters. The first of these two peculiarities of the group makes the task of defining subspecies rather difficult, especially in the olive-colored forms; the second prevents the easy definition of genera. There are not many natural genera, and most of the species have been distributed by some authors over many ill-defined monotypic genera; by others all the species have been united in the single large genus *Meliphaga* (=*Ptilotis*). I have tried to follow an intermediate course, but have not been able to avoid recognizing several monotypic genera.

For the description of colors I have used Ridgway's 'Color Standards.' The measurements used may be defined as follows: "Wing" means length of wing as flattened against the ruler; "tail" means length of the longer of the two central tail-feathers from its emergence from the skin to its tip, measured by dividers; "bill" means (in the present paper only) length of the upper mandible from its tip to the beginning of the lateral feathering, measured by dividers.

Amoromyza Richmond

Amoromyza Richmond, 1917, Proc. U. S. Nat. Mus., XLIII, p. 593, new name for:

Leptornis[2] Pucheran, 1853, 'Voy. Pôle Sud.,' Zool., III, p. 85 (Pl. xvii).
Type (by monotypy): *Leptornis sylvestris* = *Merops samoensis* Hombron and Jacquinot,

[1]Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, 469, 486, 488, 489, 502, and 504.
[2]*Leptornis* Gray, 1849, 'Gen. Birds,' I, p. 124, may be regarded an earlier quotation for this name

preoccupied by *Leptornis* Billberg, 1820, 'Enum. Insect. in Mus. Billberg,' p. 90.

Gummyza MATHEWS, 1925, Bull. Brit. Orn. Club, XLV, p. 93.

Type (by orig. designation): *Merops samoensis* Hombron and Jacquinot.

GENERIC CHARACTERS.—No wattles, coloration plain, bill and feet strong; bill curved, with distinct ridge on the upper mandible; feathers on forehead short, on the chin and upper throat stiff and bristle-like; tail very long.

The genus contains two representative species.

Amoromyza samoensis (Hombron and Jacquinot)

Merops samoensis HOMBRON AND JACQUINOT, 1841, Ann. Sci. Nat. Paris, p. 314, Samoa [terra typica restricta: Upolu] with *olivacea* Peale, 1848, *leptornis* Reichenbach, 1852, and *sylvestris* Pucheran, 1853, as synonyms.

DESCRIPTION.—See Gadow, 1884, 'Cat. Birds,' IX, p. 267. Adult males and females are alike in coloration, but the females are smaller (see measurements). Immature birds are like the adults, but the feathers are softer; the tail-feathers are more pointed, the wing-feathers (especially the first primary) more rounded; underneath and on the head they are less blackish.

Iris brownish gray, bill black, feet blackish gray. Tarsus 45–46, culmen from base 40–47.

		WING	TAIL	BILL[1]
Upolu	10 ♂ ad.	142–154(149.0)	132–140 (136.9)	31–36(32.6)
	4 ♂ juv.	138–142(141.0)	126–131(128.0)	30, 32, 33
	7 ♀ ad.	134–141(136.4)	115–127(121.1)	29–31(30.1)
	1 ♀ juv.	127		30
Savaii	3 ♂ ad.	145, 149, 151	132, 138	32, 34, 34
	1 ♀ ad.	134	119	32
Tutuila .	2 ♂ ad.	155, 155	142, 143	32, 35
	1 ♀ ad.	139	120	30

RANGE.—Samoa Islands: Upolu (March, April, 1924), Savaii (May, 1924), and Tutuila (February, 1924).

There is apparently no geographic variation in this species, although the few specimens from Tutuila average slightly larger and are somewhat darker, especially on the head.

Amoromyza viridis

RANGE.—Larger islands of the Fiji group.

Amoromyza viridis viridis (Layard)

Tatare ? viridis LAYARD, 1875, Proc. Zool. Soc. London, p. 150, Taviuni Island.

		WING	TAIL	BILL
Taviuni	5 ♂ ad.			30–33(31.6)
	2 ♂ juv.	132	113	29, 30
	8 ♀ ad.	123–126(124.2)	99, 101	30–32(31.0)
	5 ♀ juv.	118–120(119.0)	97–102(100.2)	28–31(29.2)

[1]The bill is measured in all the Meliphagidæ from the end of the feathering on the sides of the upper mandible (lower end of nasal grove) to the tip. This is the most exact bill-measurement in this family.

Most specimens molting, or badly worn.

		Wing	Tail	Bill
Vanua Levu	4 ♂ ad.	144–147(145.0)	119–124(120.8)	32, 33, 34
	2 ♀ ad.	124, 125	100, 105	32, 33
	1 ♀ juv.	123	109	32

Range.—Taviuni and Vanua Levu, Fiji Islands.

The birds from Vanua Levu are perhaps not identical with Taviuni specimens. I am not sure about this, as my Taviuni specimens are in a badly worn condition, while the Vanua Levu birds are in beautiful, freshly molted plumage. Comparing them in their present condition, the Vanua Levu birds look darker, especially on chin, forehead, around the eye, and on the ear-coverts. Bill and feet seem to be darker also, not as bright yellow as in typical *viridis*, but this may be just a seasonal change. Furthermore, they seem to be slightly larger. But all these differences are much too slight to warrant the naming of the Vanua Levu bird.

Amoromyza viridis brunneirostris, new subspecies

Type.—No. 253450, Amer. Mus. Nat. Hist.; ♂ ad.; Viti Levu, Fiji Islands; May 5, 1925; R. H. Beck.

Subspecific Characters.—Similar to *viridis*, but bill and feet blackish brown, sometimes darker, sometimes lighter, not yellow. In young birds more yellowish, only tip brownish. Coloration of plumage is different also, *brunneirostris* having a lighter and brighter olive without the blackish tinge of *viridis;* bill smaller, tail longer.

Iris brown, bill blackish brown, feet yellowish or grayish brown.

	Wing	Tail	Bill
♂ ad.	142–149(144.6)	124–131(127.1)	29–33(30.7)
♂ juv.	130–139(135.5)	114–132(125.8)	29–30(29.8)
♀ ad.	121–135(130.0)	108–120(113.5)	27–29(28.1)
♀ juv.	124, 128	118, 127	28, 29

Range.—Viti Levu Island (collected June, Dec., 1924, March, May, Oct., 1925).

Meliphacator Mathews

Meliphacator Mathews, 1930, 'Systema Avium Australasianarum,' p. 771. Type (by orig. designation): *Ptilotis provocator* Layard.

Generic Characters.—Bare skinfold around the eye; no wattles, but bare track along the upper throat; lores and forehead densely feathered; bill medium-sized and slightly curved; upper and under surfaces streaked.

Mathews quotes this genus in the 'Syst. Av. Austr.' as being published, in 1925, in the Bull, Brit. Orn. Club, XLV, p. 93. But I find this new genus recorded neither in the place mentioned nor anywhere else.

M. provocator belongs to the large group of species that used to be included in the genus *Ptilotis*, but has to be separated also if such genera as *Xanthotis* and *Foulehaio* are recognized. I therefore adopt the genus *Meliphacator* in spite of its unattractive name.

Meliphacator provocator (Layard)

Ptilotis provocator Layard, 1875, Proc. Zool. Soc. London, p. 28, Kandavu Island.

Ptilotis xantophrys Finsch, 1876, Journ. Mus. Godeffroy, IV, fasc. 12, p. 5, Fiji.

Descriptions.—See Layard, *loc. cit.*, p. 28. Males and females alike in coloration. Iris brown, bill black, feet greenish. Tarsus 29–31.

	Wing	Tail	Bill
9 ♂ ad.	101–108	77–82	20–23(21.9)
1 ♂ juv.	101	78	
7 ♀ ad.	85–91	67–71	18–19(18.4)

Range.—Only found on Kandavu Island (Fiji).

All these specimens (collected in November, 1924) are extremely worn. The actual measurements are presumably several millimeters higher. I record the measurements of the Whitney series only in order to demonstrate the great difference in size between males and females.

Foulehaio Reichenbach

Foulehaio Reichenbach, 1852, 'Handb. Spec. Orn.,' Abth. II (Meropinæ), I, p. 110. Type (by monotypy): *Philemon musicus* Vieillot = *Certhia carunculata* Gmelin.

Proceriolotes Mathews, 1925, Bull. Brit. Orn. Club, XLV, p. 94. Type (by orig. designation): *Ptilotis procerior* Finsch and Hartlaub.

Generic Characters.—Similar to *Meliphaga*, but large bare spot or wattle on the sides of the throat (below the base of the lower mandible); bill medium-sized and slightly curved; base of the bill on forehead densely feathered.

The characters of this genus are not very pronounced, and all of its species were originally described in the genus *Ptilotis*. However, since the very large genus *Meliphaga* (= *Ptilotis*) has been split up into smaller units even by such conservative authors as Stresemann and Hartert, it seems to be justifiable to recognize the genus *Foulehaio*. Furthermore, *Foulehaio* has a distinct likeness to some of the species of *Lichmera*, another rather poorly characterized, but generally accepted, genus of Meliphagidæ, and it is by no means certain that the Australian genus *Meliphaga* is really the next relative to this Polynesian group.

Foulehaio carunculata

Range.—Central Polynesia (from Fiji to Samoa).

I consider *procerior* and *carunculata* as conspecific in spite of certain differences in the coloration and in the size of the wattles. They not

only represent each other, but most of the differences are overbridged by the intermediate form *taviunensis* Wiglesworth.

Foulehaio carunculata carunculata (Gmelin)

Certhia carunculata Gmelin, 1788, 'Syst. Nat.,' I, pt. 1, p. 472, Tongatabu.

Philemon musicus Vieillot, 1826, 'Dict. Sci. Nat. (Levrault),' XXXIX, p. 480, Tongatabu.

Ptilotis flavoaurita Layard, 1876, Ibis, p. 148, Fotuna Island.

Description.—Male adult as described in 'Cat. Birds,' IX, p. 225. Female adult very similar to male, but smaller and underneath usually more washed with yellowish olive. Juvenal much brighter than the adult. Upperside more olive, black edges of the feathers on the head and blackish centers of the feathers on the back barely indicated; underside, especially middle of abdomen, olive-yellow, on the breast uniformly colored, without the scaly pattern of the adult; wattles on lower cheeks usually shorter.

The bird described as the juvenal by Gadow ('Cat. Birds,' IX, p. 226) is a different subspecies (*procerior*), distributed over the western Fiji Islands. On the other hand, the specimens from Fotuna Island, described by Layard as a different species (*flavoaurita*), is nothing else than the young of this species.

Range.—Samoan Islands, Horne Islands, Tonga Islands, and eastern Fiji Islands.

The birds of the range just mentioned do not form a perfectly uniform population. We have here the same difficulty with which I had to deal while describing the geographical variation of *Halcyon chloris santoensis*,[1] *Collocalia esculenta becki*,[2] and *Aplonis grandis grandis*.[3] Here, again, we have a species (or subspecies) with slight but irregular geographical variation. Certain extremes can be recognized without difficulty, but the majority of the islands are inhabited by intermediates. I think I am doing a better service to my fellow ornithologists by just describing the whole range of the geographical variation than to name the extremes, because it would be impossible to classify the intermediate populations.

In the following discussion I list my material from the different islands, giving remarks about the local size and color variations. Altogether I measured and compared 325 specimens from not less than fifty-seven islands.

[1] Amer. Mus. Novit., No. 469, p. 7.
[2] Amer. Mus. Novit., No. 486, p. 16.
[3] Amer. Mus. Novit., No. 504, p. 20.

SAMOA GROUP

		Wing	Tail	Bill[1]
Manua Islands	12 ♂ ad.	99–107(104.7)	80–88(83.0)	18–21(19.9)
	3 ♂ juv.	102, 103, 104	83, 83, 83	19, 19, 21
	10 ♀ ad.	92–98(93.8)	73–78(74.9)	17–19(17.8)
	♀ juv.	89–93(90.7)	73–76(74)	17–18(17.2)

Specimens were collected on all three islands (Ofu, Olosega, and Tau) in January, 1924. Due to the season most of the specimens are in a very worn condition or molting.

In comparison with birds from other islands, most of the Manua specimens can be recognized by the following characters[2]: large and very dark; upperside, upper ear-coverts, lower cheeks (base of bill), throat especially on the sides, blackish; middle of throat not, or very little, whitish; belly dark, strongly washed with olive-gray.

		Wing	Tail	Bill
Tutuila Island	♂ ad.	102–109(105.8)	82–88(85.7)	19–21(20.0)
	♂ juv.	100–104(102.3)	80–88(84.0)	19–20(19.5)
	♀ ad.	91–97(94.4)	73–78(75.5)	16–18(17.3)
	♀ juv.	89–91(90.0)	72–74(73.2)	16.5–17.5(17.0)

Most of the specimens were collected during November, 1923, and are in rather worn condition. A few specimens collected during February, 1924, are freshly molted.

The characters of the Tutuila birds are: large size, very light (whitish) coloration of the middle of the throat and of the lower abdomen; black markings of upperside, lower cheeks and sides of the throat less marked

		Wing	Tail	Bill
Upolu Island	4 ♂ ad.	99–102(100.8)	78–81(79.8)	18–20(19.0)
	1 ♂ juv.	104	79	18
	2 ♀ ad.	90, 93	71, 74	17, 17

Specimens were collected in March and April, 1924. These birds form the brightest population of the species: upperside very olive; ear-coverts, lower cheeks, and sides of throat more olive than blackish; underside conspicuously washed with olive-yellow, including belly, which is not at all whitish as in the Tutuila birds; wattles smaller; size also smaller.

[1]The bill here, as in all the other species, is measured from the beginning of the feathering on the base of the nasal operculum to the tip, this being the most accurate measurement.

[2]All these characters apply to the series. Single specimens can rarely be identified with certainty. This remark applies also to the characters I mention for the populations of the other islands.

		Wing	Tail	Bill
Savaii Island	8 ♂ ad.	93–102(98.5)	76–80(79.0)	19–20(19.5)
	1 ♂ juv.	97	80	19
	6 ♀ ad.	85–92(87.2)	67–73(70.8)	17–18(17.2)
	1 ♀ juv.	87	72	17

The specimens were collected in May, 1924, and are in fresh plumage.

The birds from Savaii Island (which lies west of Upolu) are more similar to the birds from Tutuila (east of Upolu) than to the Upolu series. They are small (even smaller) as the Upolu birds, and have small wattles, but the coloration, although somewhat intermediate, is more like that of the Tutuila birds. Savaii specimens have not the rich yellowish-olive tone on upper and underside that we find in Upolu birds.

Tonga Group

	Wing	Tail	Bill
♂ ad.	104–114(108.3)	83–92(86.9)	19–22(20.3)
♂ juv.	101–104(102.8)	83–86(84.0)	18–20(19.5)
♀ ad.	92–101(95.6)	72–82(77.9)	17–18(17.7)
♀ juv.	91–96(92.2)	72–79(75.0)	17–18(17.8)

These specimens were collected on the following thirty-seven islands of the Tonga Group (July 6–August 15, 1925): Eua, Tongatabu, Kelefesia, Tonumeia, Lalona, Telekivavau, Fonoifua, Mango, Nomukaiki, Nomuka, Hongahapai, Tofua, Kao, Fotuhaa, Haafera, Teauba, Tongua, Fakahigo, Beabea, Fonuaika, Oua, Unanukuhalaki, Tolanga, Luohoko, Uiha, Uoleva, Haano, Luohoko, Mounagaone, Ofalanga, Vavau, Kapa, Euakafa, Maninita, Late, Toku, and Fanua Lai.

Two specimens (both females) are slightly albinistic on wing and tail.

These birds agree in coloration with Savaii and Fotuna specimens, but are larger. The difference in size is over-bridged, however, by the birds from eastern Fiji and Samoa.

Horne Group

		Wing	Tail	Bill
Fotuna	7 ♂ ad.	93–98(95.9)	73–76(74.9)	18–20(19.2)
	2 ♂ juv.	95	71, 74	18, 19
	10 ♀ ad.	82–87(84.2)	63–70(66.1)	16–17(16.8)
	2 ♀ juv.	82, 85	63, 67	16.5, 17
Alofa	2 ♂ ad.	94, 97	73, 76	17.5
	1 ♀ ad.	83	64	16.5
	1 ♀ juv.	85	75	17

Specimens were collected in May, 1925; they are in fresh plumage.

Fotuna birds agree in coloration as perfectly with the Savaii series as birds from different islands can agree; it is impossible for me to find any color differences at all.

When Layard described his *flavoaurita* he had only one juvenal specimen which he compared with *procerior* from the western Fiji Islands instead of with *carunculata*. The only difference between specimens from Fotuna Island and the other parts of the range is that the Fotuna series averages smaller.

EASTERN FIJI ISLANDS

		Wing	Tail	Bill
Ono ilau	4 ♂ ad.	108–113(110.0)	88–92(89.5)	19–20(19.6)
	2 ♂ juv.	104, 105	84, 88	19.5, 19.5
	2 ♀ ad.	96, 97	80, 81	17, 17
	1 ♀ juv.	91		15
Matuku	2 ♂ ad.	104, 105	83, 84	19, 20
	3 ♀ ad.	87, 89, 92	71, 73, 75	17, 17, 17

SOUTHERN LAU ARCHIPELAGO		Wing	Tail	Bill
Ongea Levu	6 ♂ ad.	106–110(107.5)	84–90(87.2)	19–20(19.3)
	1 ♂ juv.	103	86	19
	8 ♀ ad.	89–95(92.8)	70–78(74.9)	16.5–17(16.9)
	1 ♀ juv.	93	79	17
Fulanga	1 ♂ ad.	108	88	19
	1 ♀ ad.	96	80	17
Marambo	3 ♂ ad.	105, 107	87, 88, 90	18, 18, 20
	2 ♀ ad.	94, 95	76, 80	16, 16
	1 ♀ juv.	93	79	16
Mothe	2 ♂ ad.	104, 106	85, 85	19, 20
	1 ♂ juv.	102	84	19
	2 ♀ ad.	96, 98	76, 79	17, 17.5
	1 ♀ juv.	94	78	17
Oneata	1 ♂ ad.	103	82	19
	3 ♀ ad.	93, 93, 96	75, 75, 78	17, 17, 17.5
Aiwa	2 ♂ ad.	105, 106	82, 89	19
	1 ♀ juv.	90	75	17
Lakemba	6 ♂ ad.	107–109(108.2)	88–90(88.8)	19–20(19.8)
	2 ♂ juv.	103, 104	81, 84	19, 20

Northern Lau Archipelago		Wing	Tail	Bill
Naiau	3 ♂ ad.	101, 102, 103	79, 80, 81	19, 19.5, 20
	1 ♂ juv.	101		19.5
Tuvutha	1 ♂ ad.	101	77	18.5
	2 ♂ juv.	97, 100	77, 80	18, 18.5
	5 ♀ ad.	87–91(89.0)	68, 71, 73	16.5–17(16.7)
Vanua Mbalavu	1 ♂ ad.	99	75	19
	1 ♀ ad.	84	66	15.5
	1 ♀ juv.	82	66	16
Yathata	3 ♂ ad.	100, 100, 102	80, 81	18, 18, 19
	1 ♂ juv.	98	79	18
	1 ♀ ad.	88	71	17
Vatu Vara	1 ♂ ad.	100	81	17
	2 ♀ ad.	86, 87	68, 69	16, 16.5

According to size we can arrange the birds from the eastern Fiji Islands into four groups: the birds from Ono ilau (very large), from the southern Lau Archipelago (large), from Matuku (intermediate), and from the northern Lau Archipelago (small).

In coloration these Fiji specimens agree with Tonga birds.

To show the perfect intergradation in the variation of size of the different islands, I will give in one table the wing-lengths of adult males and females

	Males	Females
Ono ilau (E. Fiji)[1]	108–113(110.0)	96, 97(96.5)
Tonga Islands	104–114(108.3)	92–101(95.6)
Southern Lau Archipelago (E. Fiji)	103–110(106.9)	89–98(93.9)
Tutuila (Samoa)	102–109(105.8)	91–97(94.4)
Manua (Samoa)	99–107(104.7)	92–98(93.8)
Matuku (E. Fiji)[1]	104, 105(104.5)	87–92(89.3)
Upolu (Samoa)[1]	99–102(100.8)	90, 93(91.5)
Northern Lau Archipelago (E. Fiji)	99–103(100.9)	84–91(87.8)
Savaii (Samoa)	93–102(98.5)	85–92(87.2)
Fotuna Island	93–98(95.9)	82–87(84.2)

At first glance this variation seems to be altogether irregular, but on closer examination it is apparent that birds from islands close to the equator are smaller than the ones from farther south.

Foulehaio carunculata taviunensis (Wiglesworth)

Ptilotis procerior taviunensis Wiglesworth, 1891, 'Aves Polynesiæ' [Abh. Mus. Dresden, 1890–1891, No. 6], p. 34, new name for *P*[*tilotis*] *similis* Layard, 1876, Ibis, p. 148, Taviuni Island [and not *Ptilotis similis* Pucheran 1853].

[1]The measured series is too small to show the full range of size-variation.

P[tilotis] buaensis, Wiglesworth, 1891, 'Aves Polynesiæ,' p. 35, Vanua Levu Island.

Subspecific Characters.—Similar to *procerior*, but smaller, throat and upper breast grayish, with very little yellow; breast-feathers without blackish shaft streaks, breast almost uniformly colored, without the scaly pattern of *procerior*, malar streak lighter, dark grayish instead of black; patch on sides of neck brighter yellowish olive; bare tract on the sides of the throat ending in a distinct wattle.

		Wing	Tail	Bill
Vanua Levu				
(Feb. 1925)	9 ♂ ad.	95–99(97.4)	74–79(77.3)	19–20(19.6)
	2 ♂ juv.	93, 97	70, 74	18.5
	4 ♀ ad.	86–91(87.8)	65–72(68.8)	16.5–17(16.6)
	3 ♀ juv.	81, 81, 83	62, 66, 66	16, 16, 17
Mathuata				
(Jan. 1925)	6 ♂ ad.	96–102(98.5)	75–81(77.5)	18–20(18.8)
	5 ♀ ad.	87–92(89.4)	67–73(70.6)	16.5–17(16.8)
Yanganga				
(Jan. 1925)	1 ♂ ad.	96	72 (!)	19
	1 ♀ ad.	90	74	17
Taviuni				
(Dec. 1924)	1 ♂ ad.	99	77	18
Kio (Dec. 1924)	1 ♂ ad.	99	76	19
	1 ♀ juv.	85	67	17
Rambi (Dec. 1924)	1 ♀ ad.	92		17
Ngamia				
(Nov. 1924)	2 ♂ ad.	94, 97		19
	1 ♀ ad.	90		17

Wiglesworth thought that the birds from Taviuni were smaller than those from Vanua Levu. However, as Wetmore has already pointed out (1925, Ibis, p. 853), there is no difference either in size or in coloration between birds from these two islands.

Foulehaio carunculata procerior (Finsch and Hartlaub)

Ptilotis procerior Finsch and Hartlaub, 1867, 'Fauna Centralpolyn.,' p. 62, Pl. v, fig. 3, Ovalau, Fiji.

Description.—Upperside dull greenish-olive, brighter on back and scapulars, more grayish on rump, feathers with fuscous or blackish centers or shaft-streaks; chin and middle of throat yellowish; feathers of breast pale gray with yellowish edges, giving the breast a scaly appearance; flanks and upper belly pale olive-gray. Middle of belly whitish, crissum and under tail-coverts buffy. From the edges of the lower mandibles along the sides of the upper throat to the ear-coverts runs a bare track, which is bordered above (cheeks) and below (sides of throat) by black feathers. Ear-coverts shining grayish-green. A patch of feathers behind the ear-coverts yellowish olive; sides of neck otherwise colored as hind neck; wings and tail blackish brown with bright olive outer edges. Iris brown, bill black, feet greenish gray. The

female and juvenal differ from the adult male in the same characters as in *caruncculata*.

RANGE.—Viti Levu and surrounding islands.

As several authors have doubted the uniformity of the birds I identified as this subspecies, I give in detail the measurements of the birds from the different islands, which show that the averages vary, but as a whole agree fairly well with the size of typical Ovalau birds.

		WING	TAIL	BILL
Ovalau (Oct. 1924, March 1925)	4 ♂ ad.	97–105(100.8)	81, 83, 83	20, 21, 21
	1 ♀ ad.	91	78	
	1 ♀ juv.	85	67	17.5
Viti Levu (June 1924, March-June 1925)	9 ♂ ad.	99–106(103.4)	80–85(83.1)	21–22(21.4)
	2 ♂ juv.	94, 96	75, 76	20, 21
	6 ♀ ad.	87–91(89.3)	68–75(71.3)	17.5–19(18.6)
Vatu Leile (Oct. 1924, March 1925)	3 ♂ ad.	105, 107	83, 87	20.5, 21, 21
	1 ♂ juv.	97	77	20
	1 ♀ ad.			18
	2 ♀ juv.	86, 89	70, 72	17.5, 19
Kawa-Kawa (Jan. 1925)	1 ♂ ad.	103	82	20
Nathoulla (Jan. 1925)	2 ♂ ad.	99, 101	78, 81	21, 22
	1 ♀ ad.	87	70	18
Yasawa (Jan. 1925)	9 ♂ ad.	99–103(100.9)	76–83(79.7)	20–23(21.2)
	6 ♀ ad.	88–91(89.4)	70–74(71.5)	18(18.0)
Kandavu (Wood-Belcher Coll., Sept. 11, 1923)	1 ♀ (?♂) juv.	96	75	20

Birds collected in October are very worn; November and December seems to be the molting season; in January the molt is being completed and birds collected during January, February, and March are in beautiful fresh plumage.

The birds from Yasawa Island are not separable from typical *procerior*, although they show a tendency to have the black markings on breast and upperside less pronounced, the flanks and the lower belly lighter, and the yellowish-olive spot on the sides of the neck less marked

The species has been reported also from Kandavu Island (Ibis, 1876, p. 392), but was not collected there by the Whitney Expedition. I have examined the single skin secured on Kandavu by C. A. Wood (see Ibis, 1925, p. 852), but it is an immature specimen and does not seem to differ from typical *procerior*. Its measurements are recorded above.

MELIARCHUS Salvadori

Meliarchus SALVADORI, 1880, Ann. Mus. Civ. Gen., XVI, p. 75. Type (by monotypy); *Philemon sclateri* Gray.

GENERIC CHARACTERS.—Strong and decidedly curved bill, laterally compressed; base of maxilla bare, BUT A NARROW TRACT OF SHORT BRISTLY FEATHERS CONNECTING NOSTRILS AND LORES. Circumocular space densely feathered; no wattles; feet very strong; tail long, graduated.

Meliarchus sclateri (Gray)

Philemon sclateri GRAY, 1870, Ann. and Mag. Nat. Hist., (4) V, p. 327, Wanga, San Cristobal, British Solomon Islands.

DESCRIPTION.—See 'Cat. Birds,' IX, p. 279, and Salvadori, 1881, 'Ornitologia della Papuasia e delle Molucche,' II, p. 322.

FEMALE.—Like male adult, but smaller.

JUVENAL.—Similar to adult, but more yellowish underneath and on the sides of the head; blackish tones on head and on the sides of the throat reduced, more olive-gray instead of blackish.

"Iris dirty white, eyelid pale blue; bill: base of upper mandible pale green, tip pale olive, under mandible straw yellow; feet silvery blue."

Bill (in adult male) from anterior edge of nostril about 21, from base about 42.

Tarsus: male 37, female 34.

	WING	TAIL	BILL	WEIGHT
♂ ad.[1]	133–140(135.9)	111–119(114.3)	29–31	77–83(80.4)
♂ juv.	118–130(123.2)	101–110(105.5)	27–29	70–74(72.0)
♀ ad.	114–121(118.0)	97–103(100.2)	25–26	50–62(54.7)
♀ juv.	107, 108, 108	89, 91	25	50–54(53.0)

RANGE.—San Cristobal Island, British Solomon Islands.

One series (collected in March, 1927) is in fine, fresh plumage. Other specimens (collected in December, 1929) are either extremely worn or molting.

GUADALCANARIA Hartert

Guadalcanaria HARTERT, 1929 (July), Amer. Mus. Novit., No. 364, p. 8. Type (by orig. designation): *Guadalcanaria inexpectata* Hartert.

Glycifohia MATHEWS, 1929 (Oct.), Bull. Brit. Orn. Club, L, p. 11. Type (by orig. designation): *Glyciphila notabilis* Sharpe.

[1]One exceptionally small specimen measured 127, 107, 29.

Generic Characters.—Bill long, slender and decidedly curved; no bare spaces or wattles on head; feathers on forehead large and soft; upperside plainly colored, underside more or less streaked.

This genus, in its original description, was based mainly on negative characters, not having naked wattles or a bare skinfold behind the gape. Aside from its coloration, it agrees very well with "*Glycifohia*" *notabilis*, the only difference being that *notabilis* has a relatively longer and more curved bill and a shorter tail. As positive characters for his new genus, Hartert mentions the long bill and the yellow tufts on the sides of the neck, as compared with members of the genus *Meliphaga*. I compared a series of *Meliphaga virescens sonoroides* (from New Guinea), which is close to *lewini*, the type species of the genus *Meliphaga*, with *Guadalcanaria* and found that the difference in the relative size of the bill is not as conspicuous as one would expect after Dr. Hartert's remarks. In *Meliphaga virescens* the bill is twenty-five per cent of the wing-length, in *Guadalcanaria inexpectata* twenty-eight per cent. Naturally *G. inexpectata* has a long bill, being a large bird, but the difference in relative size is only slight. The other character mentioned by Dr. Hartert, the tuft of yellow feathers on the side of the neck, does not seem to be of great importance either. We find in *G. notabilis* Sharpe, as well as in several species of *Meliphaga*, a tuft or spot of white feathers in the same place. Furthermore, this character often varies geographically as in *Xanthotis polygramma* from New Guinea. However, there is one character which separates *G. inexpectata* and *notabilis* from *Meliphaga*, that is the feathering of the forehead. In *Meliphaga* the basal part of the bill is covered by short and rather stiff feathers, in *Guadalcanaria* the feathers on the forehead are large and soft and do not extend over the basal part of the bill. This difference is particularly striking when we compare the measurements of the whole length of the bill (from the base of the forehead) with the length of the exposed culmen.

Guadalcanaria inexpectata Hartert

Guadalcanaria inexpectata Hartert, 1929, Amer. Mus. Novit., No. 364, p. 8, Guadalcanar, British Solomon Islands.

	Wing	Tail	Bill[1]	Culmen[2]
2 ♂ ad.	110, 113	90, 92	24.5, 25	31, 32
6 ♂ imm.[3]	105–106(105.8)	79–89(86.0)	24–25(24.7)	30–31.5(30.7)
4 ♀ imm.	94–98(95.8)	74–80(77.8)	22–23(22.5)	27–29 (28.2)

[1]Measured as the other species (see footnote, p. 2).
[2]From base of forehead.
[3]Including type.

RANGE.—Known only from Guadalcanar Island (collected July 20–27, 1927).

Dr. Hartert does not mention in the original description that most of the birds are in immature plumage. These immature birds are rather similar to the adults, but smaller and less distinctly streaked underneath; the tufts on the side of the neck are of a paler yellow, the tail-feathers narrower and softer toward the tip, the first primaries longer, broader and more rounded, and the wing-coverts much softer and more woolly. Some specimens have already acquired the body plumage of adult birds, but still retain the immature wing and tail.

Guadalcanaria notabilis

DISTRIBUTION.—Banks Islands and northern New Hebrides.

Guadalcanaria notabilis notabilis (Sharpe)

Glyciphila notabilis SHARPE, 1899, Bull. Brit. Orn. Club, X, p. xxix (also Ibis, 1900, p. 365), Vanua Lava, Banks Islands.

Glycifohia gonada MATHEWS, 1929, Bull. Brit. Orn. Club, L, p. 11 (new name for *Glyciphila notabilis* Sharpe, and not *Stigmatops notabilis* Finsch, 1898, Notes Leyden Mus., XX, p. 130, Wetter Island) (*sic!*).

SUBSPECIFIC CHARACTERS.—Back and rump rufescent, without distinct olive feather-edges; edges on wing-coverts dark rufous-brown; malar stripe, cheeks, and ear-coverts blackish with small white feather-tips; feathers on forehead and superciliary region black with not very broad white tips.

		WING	TAIL	BILL
Banks Islands	10 ♂ ad.	86–90(88.5)	69–73(71.4)	26.0
	1 ♂ juv.	89	71	26
	9 ♀ ad.	81–84(82.2)	66–69(67.7)	24–25(24.4)
Aoba Island	5 ♂ ad.	85–89(87.0)	72–77(74.5)	26–27(26.6)
	1 ♂ juv.	87	71	24
	6 ♀ ad.	79–82(81.0)	68–70(69.0)	25.0
Santo Island	4 ♂ ad.	90–95(91.8)	76, 77, 80	26–28(27.2)
	1 ♀ ad.	84	72	26

RANGE.—Banks Islands (Vanua Lava and Bligh Island) (collected November, 1926) and northwestern New Hebrides (Aoba Island, collected January, 1927, and Santo Island, collected December 1926).

November specimens are very worn and beginning to molt; December specimens are in full molt; and January birds are in fresh plumage or near the completion of the molt.

In coloration the birds of the four islands agree very well, but there are some differences in size and proportion as shown in the table of measurements. The birds from the Banks Islands are not only smaller,

but have a relatively shorter tail. The Aoba birds are intermediate in proportions between the birds from Banks Islands and Santo Island. I do not consider these differences important enough to split the birds of the range (as outlined above) into subspecies.

Mathews introduced a new name for *Glyciphila notabilis* Sharpe, pretending it was preoccupied by *Stigmatops notabilis* Finsch, thereby adding another name to the growing list of Mathewsian synonyms.

Guadalcanaria notabilis superciliaris, new subspecies

TYPE.—No. 212878, Amer. Mus. Nat. Hist.; ♂ ad.; Epi Island, New Hebrides; August 4, 1926, R. H. Beck and J. G. Correia.

SUBSPECIFIC CHARACTERS.—Similar to *notabilis*, but only hind neck rufescent, feathers of scapulars, back, and rump with olive-brown edges; wing-coverts edged with olive-cinnamon; malar stripe and lower cheeks white, only base of feathers black; lores, feathers behind the eye, and ear-coverts black, some of the ear-coverts with very narrow white tips; pileum black, only on forehead with white tips; superciliary stripe very distinct, feathers with broad white tips.

FEMALE.—Similar to male, but smaller.

JUVENAL.—Rather different from adult. All feathers on upperside with light shaft-streaks and dark edges, giving the bird a streaked appearance; superciliary stripe creamy white, feathers on lower throat and breast with narrow dusky edges, feathers on breast, abdomen, and flanks without distinct blackish shaft-streaks; belly washed with pale yellowish, in some specimens also throat, cheeks, and bend of wing washed with yellowish; wing-coverts with broad buffy-cinnamon or olive-cinnamon edges.

Iris brown, bill black, feet bluish.

	WING	TAIL	BILL
♂ ad.	88-94(91.1)	73-80(76.7)	26-29(27.5)
♂ juv.	86-90(87.5)	71-75(72.8)	24-28(26.5)
♀ ad.	80 87(84.6)	64-74(71.4)	25-26.5(25.6)
♀ juv.	81-83(82.2)	67-72(69.2)	25-26(25.3)

RANGE.—New Hebrides (Epi, Pauuma, Ambrym, Malekula, Pentecost, and Aurora).

Specimens from the six islands mentioned above agree fairly well in coloration, size, and proportions. The size of the Pauuma and Malekula specimens is slightly above average, of those from Pentecost, Aurora, and Epi below average. Aurora birds have rather short tails; however, all these differences lie within the range of possible individual variation.

The discovery of this new subspecies in the New Hebrides extends the range of this rare species considerably. Apparently the type was the only specimen of this species hitherto known.

LICHMERA[1] Cabanis

Most of the species of this genus are distributed over the islands west of New Guinea, and not having sufficient material from there, I am unable to define this genus.

Lichmera incana

RANGE.—New Caledonia, Loyalty Islands, and New Hebrides.

Lichmera incana flavotincta (Gray)

Glyciphila flavotincta G. R. GRAY, 1870, Ann. and Mag. Nat. Hist., (4) V, p. 331, Erromanga, New Hebrides.

SUBSPECIFIC CHARACTERS.—Larger than *incana* (♂, 73–74, ♀, 66) (see measurements); on the throat more grayish, and on breast and neck less brownish, some specimens almost indistinguishable.

Male and female are practically alike in coloration, but females smaller; immature birds have a softer plumage and are more yellowish olive, without the scaly pattern on breast and throat. The description and the picture of the type suggest a young bird, but Mr. N. B. Kinnear assures me that the type has not the characters of a young bird.

Males, 90 per cent; females, 10 per cent.

		WING	TAIL	BILL
Efate	8 ♂ ad.	76–79(77.8)	60–66(63.8)	18–20(18.9)
Mai	10 ♂ ad.	75.82(78.7)	62–69(66.0)	18–20(19.1)
Tongoa	3 ♂ ad.	74, 75, 79	62, 63, 67	17, 17, 18
Lopevi	6 ♂ ad.	77–80(78.5)	63–68(66.0)	18–20(18.8)
Pauuma	2 ♂ ad.	76, 78	66	18.5, 19
Ambrym	1 ♂ ad.	77	64	19.5
Malekula	3 ♂ ad.	76, 78, 79	62, 63, 65	18, 18, 18
	3 ♂ juv.	73, 75, 75	60, 61, 61	18, 19
	4 ♀ ad.	69–73(71.2)	59, 59, 59	16.5, 17, 17

RANGE.—Southern and central New Hebrides (Erromanga, Efate (= Vate or Vela), Makura, Mai, Tongoa, Epi, Lopevi. Pauuma, Ambrym, and Malekula).

There are no differences in coloration between birds from the various islands, and the differences of size in the averages are very slight.

I am much indebted to Mr. N. B. Kinnear for much valuable information about the British Museum material of this species, and for notes about the differences between *incana* and *flavotincta*.

Lichmera bougainvillei, new species

TYPE.—No. 221797, Amer. Mus. Nat. Hist.; ♂ ad.; Bougainville Island, Solomon Islands; January 13, 1928; F. P. Drowne.

---

[1] *Stigmatops* auctorum.

MALE ADULT.—Forehead grayish, with dark (blackish-brown) centers; feathers of crown blackish brown with broad olive edges; feathers of neck, scapulars, back, and rump light brownish-olive (R. XXX), centers of feathers more brownish, edges more olive; lores, cheeks, and superciliary region dull grayish-olive; lower cheeks dark grayish, chin and upper throat light grayish; ear-coverts and sides of neck grayish olive; lower throat light olive-gray; breast and belly gray, feathers with pale olive edges; flanks and lower belly dull buffy-olive; wing-feathers, wing-coverts and tail-feathers dark brown with olive edges; axillaries buffy gray.

FEMALE ADULT.—Similar to male adult, but smaller.

JUVENAL (male and female).—Feathers softer, less grayish, above and below more olive.

Iris brown, bill black, feet bluish gray.

Bill from base (♂ ad.) 30–32.5, tarsus (♂ ad.) 27–28.

	WING	TAIL	BILL
13 ♂ ad.	91–94(92.0)	69–73(70.8)	24–26(24.3)
6 ♂ juv.	83–88(85.8)	62–69(65.0)	20–24(22.3)
6 ♀ ad.	83–87(82.2)	64–67(66.0)	24–25(24.2)
2 ♀ juv.	80, 81	62, 63	23, 23

RANGE.—Mountains of Bougainville Island, Solomon Islands (December, 1927, January, 1928; Drowne, Hamlin and Richards).

I include this isolated species rather reluctantly in the genus *Lichmera.* It lacks the silvery or whitish tips to the postocular feathers and ear-coverts, which are so pronounced in most species of *Lichmera.* However, *bougainvillei* agrees better with *Lichmera* than with any other genus of Meliphagidæ in proportions of bill, wing and tail, and in its type of coloration. The species has no character that would justify the erection of a new genus.

MYZOMELA Vigors and Horsfield

Myzomela VIGORS AND HORSFIELD, 1827, Trans. Linn. Soc. London, XV, p. 316.

Type (by original designation): *Meliphaga cardinalis* Vigors and Horsfield) = *Certhia dibapha* Latham.

GENERIC CHARACTERS.—Small size; long, slender, well-curved bill; no wattles, no ear-tufts; most forms beautifully colored and with well-pronounced sexual dimorphism.

RANGE.—New Guinea (9 species!) eastward to Central Polynesia (Samoa), southward to New Caledonia and Australia, westward to Timor, Tenimber, Moluccas, and Celebes, and northward to Micronesia (Palau, Guam, and Carolines).

Myzomela jugularis Peale

Myzomela jugularis PEALE, 1848, 'U. S. Explor. Exped.,' Birds, p. 150, Vanua Levu, Fiji Islands.

Myzomela solitaria PUCHERAN, 1853, 'Voy. Pôle Sud.,' Zool. III, p. 99, (Pl. xxii, fig. 6), "Solomon Islands," error for Fiji Islands.

MALE ADULT.—Large patch on occiput and hind neck, lower back, rump, and tips of upper tail-coverts brilliant carmine. Chin and uppermost throat dull carmine, sometimes separated from orange of lower throat by an indistinct blackish band; forehead, forepart of crown, sides of head, sides of neck, back, scapulars, wings, and tail black; median and greater wing-coverts with white tips; greater wing-coverts and wing-feathers edged with olive; central tail-feathers with small, outer with larger white tips. Lower throat and breast orange, sometimes with a distinct reddish tinge; rest of underside yellowish-white. Axillaries, under wing-coverts and inner edges of wing-feathers white. Color of lower throat and upper breast, width of black band between upper and lower throat, and size of white spots on tail and wing-coverts varying individually.

FEMALE ADULT.—Similar to adult male, but duller; black on back more sooty; red patch on throat and nape smaller and less brilliant; orange-yellow on lower throat duller and paler.

IMMATURE PLUMAGE (first-year plumage).—Male: chin and upper throat red, lower throat mixed blackish and pale yellowish; upperside blackish olive; exceptionally some red feather-tips on nape and rump ("Fortschrittskleid"). Female: similar to immature male, but red patch on upper throat smaller; lower throat duller, less yellowish; never any reddish tips on nape and rump.

NESTLING PLUMAGE (juvenal).—Male and female: no red in plumage; the back is sooty black, slightly washed with brownish olive on lower back, rump, and upper tail-coverts; throat and breast are dirty grayish-olive, the rest of the underside is pale olivaceous-white.

Apparently shortly after leaving the nest, this plumage is changed into the first-year plumage, by a partial molt in which wing- and tail-feathers do not take part.

Iris brown, bill black, feet grayish or blackish.

Bill: 15–16 (♂ ad.), 14–15 (♀ ad.); bill from base 17–21; tarsus 16–18.

	WING	TAIL
♂ ad.	59–65(62.9)	37–41(39.2)
♂ imm.	57–62(60.2)	
♀ ad.	57–61.5(58.7)	35–37(35.8)
♀ imm.	55.5–60(57.8)	

RANGE.—Fiji Islands (material from forty-two islands examined).

Turtle Island (June, 1925).

Southern Lau Archipelago (Aug., Sept., 1924): Ongea Levu, Fulanga, Kambara, Wangava, Tavunasithi, Yangasa, Namuka Ilau, Mothe, Komo, Olorua, Oneata, Lakemba.

Northern Lau Archipelago (September, 1924): Thithia, Katafanga, Mango, Thikombia Ilau, Vanua Mblavu.

South-Central Fiji Islands (July, 1924); Matuku, Totoya, Moala, Vanua vatu.

Vanua Levu group (Oct., 1924 to Feb., 1925): Rambi, Namena, Koro, Makongai, Wakaya, Mbatiki.

Viti Levu (June, 1924), Ovalau (Oct., 1924).

Yasawa group (January, 1925): Waia, Viwa, Naviti, Matathoni, Nathoulla, Yasawa, Yanuya, Monariki (near Malolo).

Kandavu group (Oct., Nov., 1924): Kandavu, Yankuve, Ndravuni, Vanuakula.

Myzomela jugularis is a distinct species which has, apparently, no close relatives. As in most species of *Myzomela*, the males are far more numerous in the collection than the females. In the large series at my disposal there are 82.5 per cent males and only 17.5 per cent females. As the sexual dimorphism in this species is only slight, this percentage can not be explained by the assumption that the collector picked out the highly colored males. As a matter of fact there were collected one and a half times as many plainly colored immature males than adult and immature females combined. The same phenomemon (numerical predominance of males) is shown in all the species and subspecies of *Myzomela*, treated in the following pages.

Myzomela cardinalis

RANGE.—From central Polynesia to New Caledonia, the eastern Solomon Islands, and Micronesia.

Most of the forms, treated in the following pages as subspecies of *cardinalis*, have been described originally as full species, and have been treated as such by the majority of the recent authors, on account of their distinct characters. On the other hand, all these black and red *Myzomela* of Polynesia, Melanesia, and Micronesia, form a fairly uniform group which stands out clearly against the other species of *Myzomela* that live in the Papuan region and elsewhere. I consider it, therefore, more convenient to unite all the representative black and red *Myzomela* of the western Pacific into one species.

Myzomela cardinalis chermesina Gray

Myzomela chermesina GRAY, 1846, 'Gen. Birds,' I, Pl. XXXVIII, no locality (=Rotuma Island).

PLUMAGES.—Adult male: throat, breast, sides of breast, flanks, middle of back, and upper tail-coverts scarlet red; rest of the plumage black.

IMMATURE MALE (first-year plumage).—Similar to adult male, but duller throughout; blackish feathers of forehead and forepart of crown sometimes washed with dark reddish; primaries and secondaries edged with olive; wing-coverts edged with brownish olive; red underneath reduced and lighter; red feather-tips on lower throat, and upper breast, very much reduced, sometimes entirely absent. The reddish upper throat is, in this case, divided from the lower breast by a black throat-band; middle of abdomen, lower flanks and under tail-coverts pale cinnamon-gray; first primary round with broad outer web.

ADULT FEMALE.—Above similar to adult male, but red on back reduced, and on rump and upper tail-coverts lighter and less brilliant; wings and wing-coverts with narrow grayish-olive edges; upper throat with some reddish feather-tips; lower throat and upper breast brownish black with a slight red wash; lower breast and upper abdomen reddish scarlet with brownish-gray or brownish-black feather-bases; lower abdomen, flanks and under-tail-coverts dull cinnamon-gray or brownish black.

IMMATURE FEMALE.—Similar to adult female, but blackish parts more brownish and underside strongly washed with pale cinnamon-gray or rufous.

Bill from base (♂ ad.) 19–20; tarsus (♂ ad.) 21.5–22.

Males, 65.1 per cent; females, 34.9 per cent.

	WING	TAIL	BILL
16 ♂ ad.	76–79(77.3)	53–57(54.3)	16
11 ♂ imm.	74–76(74.8)	48–51(50.0)	15–16
8 ♀ ad.	67.5–73(70.4)	45–51(48.4)	13.5–15(14.1)
7 ♀ imm.	67–71(68.8)	45.5–49(47.6)	14–14.5(14.2)

RANGE.—Rotuma Island (260 miles northwest of Fiji). All the other localities given for this bird, as New Guinea, New Hebrides, and Carolines, are erroneous.

In this subpecies, as well as in the following ones, I have described the plumages in detail, because they have been very insufficiently known heretofore, and a great amount of the information published up to the present time (for example, in the 'Catalogue of Birds') is misleading.

Myzomela cardinalis nigriventris Peale

Myzomela nigriventris PEALE, 1848, 'U. S. Explor. Exped.,' Birds, p. 150, Upolu Samoa.

MALE ADULT.—Head (except lores and circumocular feathers which are black), hind neck, throat, upper breast, middle of back, rump and upper tail-coverts scarlet-red; rest of plumage black; inner edges of wing-feathers white.

FEMALE ADULT.—Crown, hind neck, and back blackish with an olive tinge; some feathers in the middle of the back, rump and upper tail-coverts brilliant scarlet-red; underside grayish olive, paler on the middle of the belly, flanks, and under tail-coverts; tips and lower part of the inner web of the tail-feathers whitish; edges of wing-feathers olive.

MALE IMMATURE (first-year plumage).—Head and throat scarlet; hind neck and back sooty black, with a few scarlet feather-tips; rump and upper tail-coverts scarlet; breast olive-gray, middle of belly whitish (-olive); lower belly, flanks, and under tail-coverts dull rufous-olive.

FEMALE IMMATURE (first-year plumage).—Crown dull scarlet, feathers on upper throat with pale scarlet tips; upperside blackish olive; underside (olive-) gray, lighter on belly; rump brownish, feathers with reddish tips.

MALE JUVENAL (nestling).—Hind neck, scapulars and back sooty; rump brownish gray (hair-brown); breast dull buffy-gray; middle of belly whitish gray, lower belly and flanks dull cinnamon-gray; feathers of crown, sides of face, chin and upper throat with reddish tips; some rump-feathers also with reddish tips.

Bill from base (♂ ad.) 19.5–20, tarsus (♂ ad.) 18–19.
Males, 79 per cent; females, 21 per cent.

It is strange that the adult female has less red in her plumage than the young one. However, there is no doubt that the sequence of plumage is correct as outlined above. Several of the immature females are molting, and the new feathers on the head are blackish, as we should expect.

	WING	TAIL	BILL
♂ ad. (series)	66–70.5(68.2)	42–46(44.0)	16–17(16.7)
2 ♂ imm.	66, 67.5	40, 40.5	15, 15.5
7 ♀ ad.	61.5–64(62.7)	38–42(39.7)	15.5–16.5(15.9)
6 ♀ imm.	60–63(61.6)	37–40(38.8)	15–16(15.2)

RANGE.—Samoa Islands: Tutuila (October, 1923–February, 1924, very worn or molting); Upolu (March, April, 1924, fresh or still partly molting); and Savaii (May, 1924) (fresh or molt nearly completed).

Specimens from Tutuila have a slightly lighter, more scarlet-red; but, as the specimens are very worn, I attribute this difference in coloration to bleaching.

Myzomela cardinalis cardinalis (Gmelin)

Certhia cardinalis GMELIN, 1788, 'Syst. Nat.,' I, p. 472, Tanna.

Myzomela melanogastra BONAPARTE, 1853, Compt. Rend., XXXVIII, p. 263, Tanna.

Myzomela splendida TRISTRAM, 1879, Ibis, p. 191, Tanna.

MALE ADULT.—Head (except lores and circumocular feathers), neck, chin, throat, upper breast, middle of back, rump and upper tail-coverts scarlet-red; rest of the plumage black, inner edge of wing feathers whitish.

MALE IMMATURE.—Underside buffy grayish, with olive tinge; lighter on the middle of the belly, darker on breast and sides of breast; upperside much darker, olive-gray, more rufous towards the rump; feathers on crown, sides of head, chin, upper throat, and middle of back, sometimes also on neck, rump, and upper tail-coverts with more or less broad scarlet tips; primaries edged with olive, secondaries and wing-coverts with cinnamon or rufous olive.

FEMALE ADULT.—Similar to immature male, but generally darker; scarlet coloration duller and paler and reduced to chin, uppermost throat, and forepart of crown; in some specimens there are a few red tips on the feathers of hind neck, middle of back and rump.

FEMALE IMMATURE.—There is no definite difference between adult and immature females; usually the immature specimens can be recognized by having a softer, less compact plumage, a rounder first primary, the wing-coverts edged with buff instead of buffy olive and by having less red in the plumage, especially on throat and back.

♂ ad.	Wing	Tail	Bill
Aneiteum	72, 75	50, 51	
Efate	69–74(71.0)	47–50(48.6)	17–18.5(17.9)
Epi	66–71(68.2)	44–48(46.2)	
Gaua	67.5–72(69.7)	45–48(46.7)	
Tucopia	68	48	15.5

Birds from the southern New Hebrides are slightly larger than those from the northern New Hebrides and Banks Islands.

	Wing	Tail
♂ imm.	64.5–70(67.1)	41.5–45.5(43.1)
♀ ad.	61–66(63.1)	39–44(41.3)
♀ imm (?)	59-63(61.2)	39-41(39.9)

These measurements are taken from birds of the entire range.

Bill from base (♂ ad.) 20.5–22, tarsus (♂ ad.) 19–20.

Males, 82 per cent; females, 18 per cent.

Range.—New Hebrides (specimens examined from Aneiteum, Efate, Nguna, Mau, Masaso, Makura, Mai, Tongariki, Tongoa, Epi, Lopevi, Pauuma, Ambrym, Pentecost, Aurora, Malekula, Malo, Santo, Aoba).

Banks Islands (specimens examined from Gaua, Valua, Bligh, Meralav, Vanua Lava).

Tucopia Island.

Specimens (especially young birds) from the northern islands (Pentecost, Aoba, and Banks Islands) usually have less red in the plumage than birds from the southern islands (Aneiteum to Epi), but some birds are indistinguishable. The only specimen from Tucopia has even less red on upper breast and hind neck than specimens from the northern New Hebrides and Banks Islands, but more material has to be examined to decide upon the constancy of this character. In size there is also some slight geographical variation. Birds from the southern New Hebrides are the largest, birds from the central New Hebrides (Epi and neighboring islands) are smallest, while the birds from the northern New Hebrides and Banks Islands are intermediate in size. However, these differences are too slight to justify the naming of new races.

South of the New Hebrides the species is represented by *caledonica* Forbes (New Caledonia) and *lifuensis* Layard (Loyalty Islands).

Myzomela cardinalis sanctaecrucis Sarasin

Myzomela rubratra sanctaecrucis F. Sarasin, 1913, 'Vögel Neu-Caledoniens,' p. 75, Santa Cruz Island, Santa Cruz Group.

MALE ADULT.—Head, middle of back, rump, upper tail-coverts, upper abdomen, breast, flanks scarlet; middle of belly, under tail-coverts, scapulars, wings, and tail black; lores and sometimes chin and frontal feathers also black.

MALE IMMATURE.—Upperside grayish olive-brown, some feathers on the back, more sooty; feather-tips on forehead and forepart of crown, middle of back, rump, and upper tail-coverts scarlet; hind neck and sides of neck washed with dirty brownish-red; chin, throat, cheeks, and ear-coverts scarlet-red; breast and flanks scarlet; abdomen grayish yellow with a pink wash; sides of throat olive-brown; wing-coverts blackish with rufous-olive edges; wing-feathers with olive outer, and whitish inner edges; axillaries yellowish white.

FEMALE ADULT.—Head and neck fuscous olive, on the forehead strongly, otherwise slightly washed with dark reddish; scapulars and back darker, more sooty; some feathers on the middle of the back with narrow, all feathers on rump and all upper tail-coverts with broad scarlet tips; underside yellowish or olive-gray, darker on the breast, chin, throat, and breast washed with reddish; wing, wing-coverts, and tail edged with olive.

FEMALE IMMATURE.—Apparently not different from the adult. The bird described as juvenal by Sarasin (*loc. cit.*, p. 75) is a female.

Bill from base (♂ad.) 20.5–21, tarsus (♂ ad.) 20–21.

Males, 81.8 per cent; females, 18.2 per cent.

		WING	TAIL	BILL
Torres Islands	♂ ad.	73	48	17.5
Vanikoro		72–78(74.8)	48–51.5(49.9)	17.5–18.5(18.0)
Utupua		72–76(74.1)	48–51(49.8)	
Santa Cruz		75–78(76.2)	50–53(52.0)	18–19(18.2)
Reef Islands		75–79(76.8)	49–53(51.3)	
Duff Islands		74–79(76.6)	49–54(51.7)	
	♂ imm.	72–74(73.0)	47–48(47.2)	
	♀	64–69(66.2)	41–47(43.3)	

RANGE.—Torres Islands (Lo, Hiu) (November, 1926). Santa Cruz Islands (Vanikoro, Utupua, Santa Cruz) (September, October, 1926, February, 1927). Reef (or Swallow Islands) (Nupani, Fenualoa, Lomlom) (October, 1926). Duff Islands (Disappointment Islands, Treasurers Island) (October, 1926).

There is no difference between the birds from the various localities. The single male and female from the Torres Islands also agree with typical *sanctæcrucis*, although the Banks Islands, inhabited by *cardinalis*, are much nearer than Santa Cruz.

Myzomela cardinalis sanfordi Mayr

Myzomela cardinalis sanfordi MAYR, 1931, Amer. Mus. Novit., No. 486, p. 27, Rennell Island.

Males, 80 per cent; females, 20 per cent.

Description and measurements are given in Amer. Mus. Novit., No. 486, pp. 27–28.

RANGE.—Rennell Island.

Myzomela cardinalis pulcherrima Ransay

Myzomela pulcherrima RAMSAY, 1881, Proc. Linn. Soc. N. S. W., VI, p. 179, Ugi, Solomon Islands.

MALE ADULT.—Similar to *sanctæcrucis*, but red darker, less brilliant; red tips of feathers narrower; primaries with distinct olive edges.

MALE IMMATURE.—Above like adult male, but red and black colors duller; throat red, rest of underside olive-gray, with pale reddish feather-tips or only with a red wash; wing-coverts edged with reddish olive, primaries with olive.

FEMALE ADULT.—Head, throat, middle of back, rump, and upper tail-coverts red; scapulars and sides of breast sooty or sooty olive; underside grayish olive, breast, upper abdomen, and flanks more or less strongly washed with red; wing-coverts and wings edged with olive.

Bill from base (♂ ad.) 20–21.5, tarsus (♂ ad.) 19–20.

Males, 68.8 per cent; females, 31.2 per cent.

	WING	TAIL	BILL	WEIGHT
9 ♂ ad.	70–74(71.6)	44.5–47(45.9)	17–18(17.5)	13–16(14.6)
1 ♂ imm.	69	43	17	
1 ♂ ad. (? hybrid)	72	47	17.5	
5 ♀ ad.	63–65.5(64.0)	38–41(39.8)	15–16(15.5)	13

Two females from Ugi Island seem to have the red on the flanks extended lower than the three females from San Cristobal, but otherwise they are absolutely alike.

RANGE.—San Cristobal (=Bauro) (April, 1927, December, 1929) and Ugi Island (April, 1927), British Solomon Islands.

There is one unusual specimen in the series from San Cristobal (No. 218332, collected April, 6, 1927). Its general color is black, but the black feathers have sombre red tips on head, throat, ear-coverts, middle of back, rump, and upper tail-coverts, also some very narrow reddish tips on the feathers of breast and flanks; the axillaries and under wing-coverts are light gray.

There are two ways to explain the coloration of this specimen: either it is a melanistic phase, or a hybrid between *Myzomela cardinalis pulcherrima* and *Myzomela nigrita tristrami*.

In favor of the hybrid possibility is the fact that there is no other melanistic specimen of *Myzomela* in the large series of the Whitney Collection from all Polynesia but this one blackish specimen from the only island where the ranges of *cardinalis* and *nigrita* overlap.

There are no other characters that distinguish *cardinalis* and *nigrita*, except coloration; the measurements overlap (see also p. 29).

Myzomela cardinalis malaitæ Mayr

Myzomela cardinalis malaitæ MAYR, 1931, Amer. Mus. Novit., No. 504, p. 25, Malaita Island.

DESCRIPTION AND MEASUREMENTS.—See Mayr, *loc. cit.*. p. 25.

Males, 81.2 per cent; females, 18.8 per cent.

RANGE.—Malaita, British Solomon Islands.

This remarkable subspecies somewhat approaches *Myzomela lafargei* and allies from the western Solomon Islands in its pattern of coloration.

In Micronesia live *Myzomela cardinalis rubratra* (Lesson) and allied forms.

SUPERSPECIES *Myzomela lafargei*

There are three closely related representative species of *Myzomela* in the Solomon Islands that could be considered as subspecies of one species: *melanocephala*, *lafargei*, and *eichhorni*. However, one of them (*eichhorni*) is divided into several subspecies. Furthermore, each of them has rather distinct peculiarities of pattern and coloration. I prefer therefore to keep them specifically separated, but unite them in one superspecies.

Myzomela lafargei Pucheran

Myzomela lafargei PUCHERAN, 1853, 'Voy. Pôle Sud.,' Zool., III, p. 98 (Pl. XXII) [Ysabel Island] Solomon Islands.

MALE ADULT.—Forehead, forepart of crown, sides of head, chin, throat, back, scapulars. rump, and upper tail-coverts black; large patch on hind neck red, some feathers on rump and upper tail-coverts also sometimes reddish; underside (except throat) golden olive, duller on flanks, lower belly, and under tail-coverts. Outer edge of wing-coverts and wing-feathers olive-ocher; inner edge of wing-feathers, under wing-coverts and axillaries white; some specimens have reddish tips on the black rump-feathers.

FEMALE ADULT.—All the plumage olive, only chin and cheeks with a reddish tinge; upperside much darker, centers of the feathers on the crown blackish; back, scapulars, and rump brownish olive, throat fuscous olive, rest of underside yellowish to ocher-olive.

MALE IMMATURE.—Upperside blackish, grayish or brownish with olive tinge, very dark; forehead and crown dark red; chin, upper throat, cheeks and sometimes ear-coverts washed with cherry red; underside orange or ocher-olive, duskier on the throat, paler in the middle of the belly.

FEMALE IMMATURE.—Similar to immature male, but duller; not so dark (blackish) on the upperside, and more olive below.

Bill from base (♂ ad.) 20.5–21, tarsus (♂ ad.) 16.5–17.

Males, 72 per cent; females, 28 per cent.

This is another of the interesting cases where the adult female has less red in the plumage than the young one. (See *Myzomela cardinalis nigriventris*, pp. 20, 21.)

	WING	TAIL	BILL	WEIGHT
♂ ad.	64–68(66.2)	42–48(44.6)	16–18(17.2)	12–14(13.1)
♂ imm.	61–67(63.4)	39–43(41.2)		
♀ ad.	57–60(58.5)	36–41(38.2)	16–17(16.2)	10, 10.5, 11
♀ imm.	55, 56, 57	35–37(35.8)		

RANGE.—Northern Solomon Islands (Ysabel, Molakobi, Megapode, Arnavon, Choiseul, Fauro, Bougainville, and Buka Islands).

Birds from Bougainville in the series are rather more olive underneath, without the golden, even reddish-golden tinge of most of the Ysabel birds. However, some specimens are indistinguishable, and the only Buka skin is as reddish golden as the most extreme of the Ysabel specimens. Some of the Bougainville birds have the red patch on the nape rather small, but none of these differences is very constant.

Myzomela melanocephala (Ramsay)

Cinnyris melanochephalus RAMSAY, 1879 (June 5), Nature, XX, p. 125, Savo Island.

Cinnyris (?) *dubia* RAMSAY, 1879 (June 16), Proc. Linn. Soc. N. S. W., IV, p. 83, Savo Island.

Myzomela sharpei OGILVIE-GRANT, 1888, Proc. Zool. Soc. London, p. 197, Pl. x, fig. 3, Guadalcanar Island [descr. of immature].

MALE ADULT.—Forehead, crown, sides of head, ear-coverts, chin and middle of throat glossy black; hind neck blackish olive; back, scapulars, sides of neck, and upper breast rich (golden-) olive; belly, flanks and under tail-coverts pale grayish-olive.

FEMALE ADULT.—Similar to male, but smaller and duller; black on head and throat more restricted, abdomen much lighter.

IMMATURE (male and female).—Similar to adult, but duller; olive colors replaced by ochraceous or cinnamon (-olive), especially on the edges of the wing-coverts, on rump, and lower belly.

Bill from base (♂ ad.) 20–21, tarsus (♂ ad.) 16 mm.

Males, 70.7 per cent; females, 29.3 per cent.

	WING	TAIL	BILL
♂ ad.	64–67(65.6)	42.5–47(45.1)	16.5–18(17.2)
♂ imm.	62–64.5(63.5)	40–43(42.0)	
♀ ad.	58.5–60(59.6)	38–42.5(39.8)	
♀ imm.	57.5, 59	37.5, 38.5	16, 16

RANGE.—Guadalcanar, Beagle Island (W. S. S. E.), Savo (Cockerell); Florida Island (cf. Nov. Zool., 1901, p. 181, and Ibis, 1892, p. 298).

Myzomela eichhorni

RANGE.—Central group of Solomon Islands.

Myzomela eichhorni eichhorni Rothschild and Hartert

Myzomela eichhorni ROTHSCHILD AND HARTERT, 1901, Nov. Zool., VIII, p. 181, Kulambangra Island.

Myzomela eichhorni interposita ROTHSCHILD AND HARTERT, 1917, Bull. Brit. Orn. Club, XXXVII, p. 38, New Georgia (and Rendova).

MALE ADULT.—Feathers of throat, rump, and upper tail-coverts bright scarlet; rest of plumage more or less greenish olive; upperside dark greenish-olive, feather centers fuscous; head and hind neck fuscous olive; underside lighter, especially middle of abdomen; breast richer olive; sides of throat fuscous olive; wing and tail-feathers fuscous with olive edges.

FEMALE ADULT.—Similar to adult male, but scarlet on rump absent, and on throat duller and more restricted; upperside lighter, more olive and less fuscous; rump cinnamon- or rusty-olive; underside distinctly paler than in male, olive colors mixed with buffy tones; outermost tail-feathers with pale tips.

IMMATURE MALE.—Crown, neck, scapulars, and back fuscous olive, crown darker, partly blackish; forehead somewhat washed with reddish; hind neck lighter; rump and upper tail-coverts cinnamon (-olive); middle of throat with elongated scarlet-red feathers; underside light cinnamon-olive, more grayish on the sides of the throat, more buffy in the middle of the abdomen; wing-coverts edged with olive-cinnamon, wing- and tail-feathers edged with olive; under wing-coverts and inner edges of wing-feathers whitish, axillaries yellowish white.

IMMATURE FEMALE.—Similar to adult female, but more washed with cinnamon, particularly on the rump.

JUVENAL.—The juvenal (nestling) plumage is very dull. It lacks the olive tinge above and underneath, and the scarlet is restricted to a dark reddish-gray spot in the middle of the throat.

Bill from base (♂ad.) 21–22, tarsus (♂ ad.) 17–17.5.

Males, 69.6 per cent; females, 30.4 per cent.

		WING	TAIL	BILL
Gizo	♂ ad.	69, 70	46, 47	
Kulambangra		69–73(70.6)	46–50(48.0)	17–19(18.6)
New Georgia		68.5–72(70.1)	46–50(48.2)	
Vangunu		71, 71	49, 49	
Rendova		69–72(70.2)	46–50(47.9)	
	♂ imm.	65–69.5(67.8)	43–46(44.6)	18
	♀ ad.	61–65(62.4)	39–44(41.4)	16–18(17.5)

RANGE.—Eastern part of the central group in the Solomon Islands (Gizo, Kulambangra, New Georgia, Vangunu, Rendova, and Tetipari).

Rothschild and Hartert in 1917 separated the birds from New Georgia and Rendova from the typical form as having the red patch on the throat "much more elongated in both sexes, at least 5 mm. longer in the male." Their specimens from New Georgia and Rendova were collected in 1904,

while the typical series from Gizo and Kulambangra was collected in 1901. The difference in the shape of the red throat-patch in the Tring series is undoubtedly due to the different method of preparation in 1901 and 1904, as the differences are not substantiated by the Whitney material.

Myzomela eichhorni ganongæ, new subspecies

TYPE.—No. 220206, Amer. Mus. Nat. Hist.; ♂ ad.; Ganonga Island, British Solomon Islands; October 20, 1927; R. H. Beck and F. P. Drowne.

SUBSPECIFIC CHARACTERS.—General coloration in both sexes intermediate between *eichhorni* and *atrata;* back of male not black, but fuscous olive, darker than in *eichhorni;* underside dull grayish-olive, more blackish toward the breast, without the rich olive tone of *eichhorni* and not blackish as in *atrata*; underneath, the female is very similar to that of *atrata*, only slightly lighter, but above it is fuscous-olive, not fuscous; no red tips to the feathers on the rump.

	WING	TAIL	BILL
6 ♂ ad.	67–69 68.2)	44, 46, 47	17.5–19(18.0)
2 ♀ ad.	59, 60	36, 39	17, 17.5

RANGE.—Ganonga Island, British Solomon Islands.

Dr. Hartert identified two specimens of this new subspecies as *Myzomela eichhorni atrata* (Amer. Mus. Novit., No. 364, p. 10), but with the series of eight specimens at my disposal, the differences (as described above) are very conspicuous.

Myzomela eichhorni atrata Hartert

Myzomela eichhorni atrata HARTERT, 1908, Bull. Brit. Orn. Club, XXI, p. 105, Vella Lavella Island.

DESCRIPTION.—See Hartert (*loc. cit.*, p. 105). The female however, does not always have the "feathers of the rump broadly tipped with red." On the other hand, I have a few females of typical *eichhorni* with some narrow red tips to the feathers of the rump.

		WING	TAIL	BILL
Vella Lavella	5 ♂ ad.	67–70(69.0)	43.5–46(44.6)	17.5, 18
	1 ♂ juv.	61	38	
	4 ♀ ad.	60–63(61.8)	40, 40, 41	
	1 ♀ imm.	61		
Bagga	4 ♂ ad.	69, 69	47, 47	17–18(17.4)
	2 ♀ ad.	62, 63	40	

RANGE.—Vella Lavella and Bagga, British Solomon Islands.

Myzomela nigrita

RANGE.—Numerous subspecies occur in New Guinea and neighboring islands, in the Admiralty Islands, and the Bismarck Archipelago. Only one subspecies lives in the Solomon Islands.

Revision: Stresemann, 1923, Arch. f. Naturg., LXXXIX, fasc. 7, pp. 50, 51. Additional notes: see Meise, 1929, Ornith. Monatsb., XXXVI, p. 84.

Myzomela nigrita tristrami Ramsay

Myzomela Tristrami RAMSAY, 1881 (Sept.), Proc. Linn. Soc. N. S. W., VI, p. 178 [terra typica presently fixed as San Cristobal Island]. [Original description is based on immature bird.]

SUBSPECIFIC CHARACTERS.—Black of plumage dull, not glossy; agrees in size with *ramsayi* Finsch, but has the axillaries and most of the under wing-coverts grayish or blackish, not purely white; no sexual dimorphism, except that the female is smaller, and has a duller, more sooty black.

The immature bird of this race is distinguished by having a dark yellow bill with black tip, its body plumage is black, except for breast and belly where the black is reduced to the feather-tips, while the bases of the feathers are olivaceous gray on the breast, and cinnamon gray on belly and under tail-coverts; in the nestlings plumage the bird is (judging from some molting specimens) probably grayish olive underneath and sooty above.

Bill from base (♂ ad.) 20–21, tarsus (♂ ad.) 17–18.

Males, 61.8 per cent; females, 38.2 per cent.

	WING	TAIL	BILL	WEIGHT
♂ ad.	67–72(69.3)	42–47.5(45.6)	17–19(18.0)	13–16(14.7)
♀ ad.	61.5–66(63.7)	40–46(42.5)	15–16.5(16.1)	11.5, 14
♂ imm.	65.5–68.5(67.2)	44–46(44.8)		12.5
♀ imm.	60–65(62.3)	38–42.5(40.2)		10, 11, 11

RANGE.—San Cristobal and Santa Anna Island, British Solomon Islands. The species has also been recorded from Ugi Island (Ramsay, 1882, Proc. Linn. Soc. N. S. W., VII, p. 27), but was not found there by the Whitney Expedition.

Two specimens from Santa Anna have a few red-edged feathers on the rump. It is doubtful if this can be attributed to hybridization with *pulcherrima*, as no *pulcherrima* have been collected in this locality. Further collecting is necessary to solve this question.

Hartert suspects, after an examination of scanty material, that specimens from Santa Anna are larger than San Cristobal birds (Amer. Mus. Novit., No. 364, p. 9). However, my large series do not bear out his assumption. The wing-length of twelve males from San Cristobal is 67–70 (69.1), while in eleven males from Santa Anna it is 67–72 (69.4). The averages are practically the same.

The species *nigrita* may be divided into two groups: a *nigrita* group living in New Guinea and neighboring islands, and a *pammelæna* group distributed over the Admiralty Islands, the Bismarck Archipelago, and

the Solomon Islands. The subspecies of the *pammelæna* group are characterized by large size (wing in adult males 67–78, against 53–67 in *nigrita*), by grayish instead of white axillaries and under wing-coverts, and by lacking sexual dimorphism. In *nigrita* the females always have a tone of olive in their plumage and a reddish tinge on forehead and cheeks. However, as some forms are somewhat intermediate, I prefer to adopt Stresemann's arrangement (*loc. cit.*, 50, 51), who regards *nigrita* and *pammelæna* as conspecific.

AMERICAN MUSEUM NOVITATES

Published by
Number 517 The American Museum of Natural History Feb. 23, 1932
New York City

59.57, 72 D

THE GENUS *DICTYA* MEIGEN (TETANOCERIDÆ, DIPTERA)

By C. H. Curran

In the two revisions of the American species belonging to the family Tetanoceridæ the only species of *Dictya* included is *umbrarum* Linnæus, a European species. Being aware of the existence in North America of more than one species of *Dictya*, I asked Mr. Colbran J. Wainwright if he could let me have specimens of *umbrarum* and he very kindly sent three of them.

Since all the known species of *Dictya* bear a very close resemblance to each other, their separation by other than genitalic characters is almost impossible. Fortunately, both sexes display good genitalic characters and in the case of the females no preparation of the specimens is necessary. With the males it is only necessary to relax them and spread the genitalia.

In the illustrations prepared for this paper all the figures of the parts of the male genitalia are drawn from lateral view, all are drawn to the same scale, and I have illustrated only those parts by which the species may be most easily identified. In all cases where an interpretation of genitalic figures is being made it must be remembered that a slight alteration in the angle from which the object is viewed will usually give a different appearance. In the case of the present figures I have drawn them so that the greatest width of the anterior clasper is shown and have made, at most, slight changes in the apical portion (as seen from this view), in order to bring out the characteristic shape. In the present case also I do not believe that the shape of the whitish, anterior appendage on the anterior clasper is of much diagnostic importance, since it is so easily damaged in spreading the genitalia, although it is probable that in specimens prepared by removing the abdomen, and following the usual procedure in preparing slides, another excellent character for the separation of the species would be available.

In the present case I have made use of only the anterior and posterior claspers in the male and of the eighth sternite in the female. In most of the species the posterior claspers are very similarly shaped and show only minor variation in this respect, and since the posterior lobe is rather

soft, too much reliance must not be placed upon its shape. The anterior or inner claspers give the best and most easily available characters and a single glance is usually sufficient to identify the species. Whether the outer forceps or "auxilliary lobe" presents reliable characters or not is open to question, since these organs are thin and may be more or less curved. I suspect that they show much more variation than the other parts. The penis also exhibits distinct differences, but, since it is usually concealed by the claspers, it is not readily available for taxonomic study. The posterior forceps also are concealed, and I have made no attempt to study them.

The figures of the eighth sternite must not be interpreted along too strict lines, as each specimen shows slight differences due to drying. In order to secure the exact shape of this it is necessary to treat with caustic and remove all adjacent parts. I have drawn what I believe to be the typical structure of this sternite in each of the species but I must point out that I have no proof, other than the locality, size and minor color characters, that the females are properly associated with the males.

The following is the synonymy of the genus.

Dictya Meigen

Meigen, 1803, 'Illiger's Mag.,' II, p. 277.
Monochætophora Hendel, 1900, Verh. Zool.-bot. Ges., Wien, L, p. 355.
Monochætophora Cresson, 1920, Trans. Amer. Ent. Soc., XLVI, p. 68.
Dictya Melander, 1920, Ann. Ent. Soc. Amer., XIII, p. 322.

The genotype is *Musca umbrarum* Linnæus, the only recognized palæarctic species.

Dictya may be readily distinguished from other Tetanoceridæ by the following characters: clypeus not prominent; propleural bristle absent; scutellum with four bristles; mesopleura and pteropleura each with a strong bristle and the absence of sternopleural bristles.

Table of Species

Since all the species in this genus are so similar in appearance and are only to be recognized by genitalic characters I present only a key to the males. The females may be determined by association with the males and by consulting the figures.

1.—Posterior claspers with a distinct lobe below which bears dense bristly hairs apically (Fig. 12).. .... *borealis*, n. sp.
Posterior claspers with a preapical emargination and with much shorter, never caudally directed hairs on the lower part......................... ....2.
2.—Apex of the inner claspers strongly produced anteriorly and posteriorly (Fig. 5). *pictipes* Loew.

Apex of inner claspers never strongly produced posteriorly.. . . . . .3.

3.—Apical portion of the inner claspers tapering and produced anteriorly.. . . . . .4.

Apical portion of inner claspers never conspicuously tapering nor curved anteriorly. . .. . .5.

4.—Anterior claspers broad, not regularly tapering (Fig. 1) . . *umbrarum* Linnæus.

Anterior claspers narrow and regularly tapering (Fig. 3) . . *umbroides*, n. sp.

5.—Apical portion of the anterior clasper with a long anterior process (Fig. 9). *lobifera*, n. sp.

Apical portion of anterior clasper at most weakly produced beyond a deep emargination. ... . .6.

6.—Anterior clasper broad and with a deep anterior margination (Fig. 11). *incisa*, n. sp.

Anterior clasper with the apical half narrow and much more weakly emarginate in front (Fig. 7)... . . . .*texensis*, n. sp.

Dictya umbrarum Linnæus

Figures 1 and 2

Musca umbrarum Linnæus, 1761, 'Fauna Suec.,' p. 1864.

Meigen, 1803, 'Illiger's Mag.,' II, p. 277.

Pherbina paludosa Desvoidy, 1830, Mem. Acad. Roy. Sci. Inst. France, II, p. 691.

For complete synonymy of *umbrarum* see 'Kat. Pal. Dipt.,' IV, p. 65.

The following description applies quite well to all the species.

Male.—Length, 4 to 6 mm. Face moderately retreating, perpendicular on the lowest third, the median third gently convex longitudinally, the parafacials also more or less convex toward the eyes. Face and cheeks white, the latter with a large brownish spot in front. Front dull honey-yellow, the orbits very narrowly white; two large brown spots, each hair arising from a small spot; ocellar triangle dull yellowish brown. Occiput whitish, each hair arising from brown spot. One parafrontal bristle, the verticals, outer verticals and postverticals strong. Cheeks one-third as wide as the eye-height. Palpi yellow. Antennæ reddish; second segment scarcely longer than wide, third somewhat longer than the second, concave above, the apex obtuse; arista with sparse, long black rays.

Thorax cinereous pollinose, the mesonotum with about four rows of irregular brown blotches, and often with many of the hairs arising from brownish spots; pleura usually with more or less conspicuous brown areas. Two pairs of dorsocentrals; two pairs of scutellars, the disc setulose; pleura setulose, the mesopleura with a bristle above posteriorly, the pteropleura with one in the middle.

Legs reddish yellow, the femora with two broad, more or less entire, brown bands on the apical half; tibiæ brown apically; tarsi with the apical two or three segments brown, the basal segment more or less brown.

Wings about equally brownish and cinereous hyaline on the anterior half, and grayish and hyaline on the posterior half, the clear spots more or less rectangular on the anterior half of the wing and more rounded on the posterior half. The intensity of the color varies and the wing may be mostly brown although it is always paler behind and deeper in color along the costa. In some specimens the clear color predominates.

Abdomen mostly brownish but with extensive cinereous white areas.

This is the only recognized palæarctic species, but in view of the fact that there are several American species it would not be surprising to find that more than one form has been confused under this name. The species has a wide range in Europe, according to the records, but the question of even varietal differences has never been raised. It is readily distinguished from *umbroides* by the shape of the anterior claspers of the male and the presence of setulæ on the median portion of the eighth sternite in the female.

Two males and one female, Staateidiger, near Meiningen, Germany, August 15, 1907, ex collection Girschner, received from Mr. Colbran J. Wainwright.

In addition to the European specimens there are three specimens from Monterey, California, July 13, 18 and 22, 1896 (Wheeler Collection), which show no genitalic differences in either sex except that the anterior claspers are more evenly tapering and do not display the irregularity shown in the figure. The male is 5.5 mm., the females 6 mm. in length. Notwithstanding the difference in size I believe that they represent the true *umbrarum*. However, a thorough study of the entire genitalia may provide tangible differences, but my material is too scanty to permit such a comparison.

Dictya umbroides, new species

Figures 3 and 4

Very similar to *umbrarum* Linnæus from which it is distinguished only by genitalic characters. In the male the anterior claspers are rather evenly tapering on the apical portion and form a long hook, while in the female the median portion of the eighth sternite is bare or has only one or two setulæ.

Types.—Holotype, male, and allotype, female, Banff, Alberta, Canada, June 1, 1922. Paratypes: male, Banff, June 1, four females, Banff, May 5 and June 18, 23 and 29, 1922, all collected by C. B. D. Garrett; male, Glen Souris, Manitoba, August 23, 1923 (H. A. Robertson); female, Aweme, Manitoba, August 15, 1923 (N. Criddle). The types are in the Canadian National Collection, paratypes in The American Museum of Natural History.

Dictya pictipes Loew

Figures 5 and 6

Tetanocera pictipes Loew, 1859, Wien. Ent. Monatschr., III, p. 292.
Tetanocera pictipes Loew, 1862, 'Mon. N. A. Dipt.,' I, p. 111.
Monochætophora umbrarum Cresson, 1920, Trans. Amer. Ent. Soc., XLVI, p. 70.
Dictya umbrarum Melander, 1920, Ann. Ent. Soc. Amer., XIII, p. 322.

An easily recognized species in both sexes. In the male the anterior claspers are characteristically produced apically and in the female the

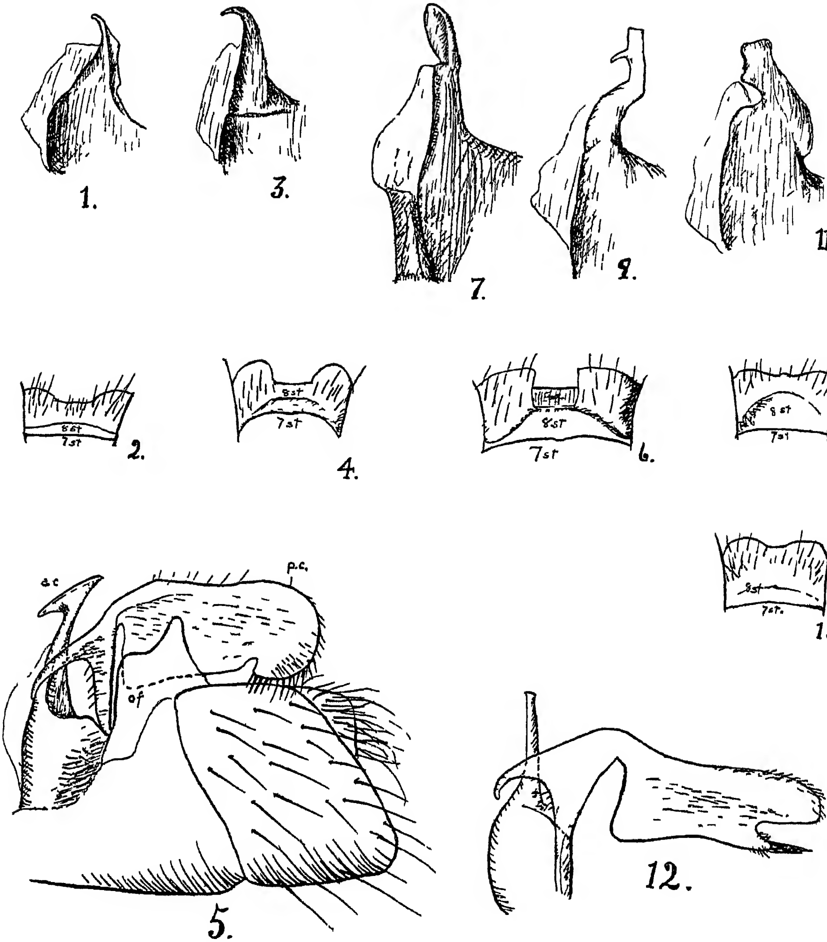


Fig. 1. *Dictya umbrarum* Linnæus, lateral view of anterior clasper of male.
Fig. 2. *Dictya umbrarum* Linnæus, ventral view of eighth sternite of female.
Fig. 3. *Dictya umbroides*, new species, lateral view of anterior clasper of male.
Fig. 4. *Dictya umbroides*, new species, ventral view of eighth sternite of female.
Fig. 5. *Dictya pictipes* Loew, lateral view of male genitalia showing claspers and outer forceps.

a c, anterior claspers; *p c.*, posterior claspers, *o.f*, outer forceps.

Fig. 6. *Dictya pictipes* Loew, ventral view of eighth sternite of female.
Fig. 7. *Dictya texensis*, new species, lateral view of anterior clasper of male.
Fig. 8. *Dictya texensis*, new species, ventral view of eighth sternite of female.
Fig. 9. *Dictya lobifera*, new species, lateral view of anterior clasper of male.
Fig. 10. *Dictya lobifera*, new species, ventral view of eighth sternite of female.
Fig. 11. *Dictya incisa*, new species, lateral view of anterior clasper of male.
Fig. 12. *Dictya borealis*, new species, lateral view of anterior and posterior claspers of male.
Fig. 13. *Dictya borealis*, new species, ventral view of eighth sternite of female.

eighth sternite is deeply excavated. There is some variation in the width and depth of the excavation of the sternite, but this is all within a moderately narrow range and may be largely due to drying.

D. pictipes has a wide distribution. In the north the species ranges from Nova Scotia to Saskatchewan and Wyoming and south to Texas. It was originally described from Washington, D. C., and the Museum collection contains one of the original lot collected by Osten Sacken.

Dictya texensis, new species

Figures 7 and 8

The genitalia of both sexes show characteristic differences. While the apical portion of the anterior clasper is distinctly notched near the middle, there is no deep emargination such as occurs in *incisa*, new species. This form is apparently intermediate between the species with the curved claspers and those which have parallel sides or are more or less clubbed apically. The eighth sternite of the female is gently emarginate apically and bears a small median convexity.

TYPES.—Holotype, male, Austin, Texas, February 22, 1900, and allotype, female, Austin, October 7, 1899 (Wheeler Collection). Paratypes, male, Austin, February 22, 1900 (Wheeler Collection), and female, Morgan, New Jersey, August 7 (Weiss and West).

Dictya lobifera, new species

Figures 9 and 10

The male may be readily distinguished by the presence of the narrow lobe on the anterior surface of the anterior claspers.

TYPES.—Holotype, male, Ormond, Florida (Slosson Collection); allotype, female, Lake Worth, Florida (Slosson Collection). Paratypes, female, Biscayne Bay, Florida (Slosson Collection); female, Salt Meadows, New Jersey, July (A. J. Weldt); female, Orange Mts., New Jersey, July (A. J. Weldt); female, Cerro Cabras, near Puerto del Rio, Cuba, September 11, 1913. Paratypes in the Canadian National Collection.

Dictya incisa, new species

Figure 11

The broad, broadly excised anterior claspers render the male easily identifiable. In the presence of the posterior depressed portion *incisa* apparently shows a relationship to *umbrarum* Linnæus. The blunt apex is usually wide but from most views appears narrower than shown in the figure.

TYPES.—Holotype, male, and paratype, male, G. Zuni River, Arizona, July 27 (Wheeler Collection).

Dictya borealis, new species

Figures 12 and 13

The male of this species can usually be recognized without spreading the genitalia, as the apical part of the posterior clasper is normally visible and its shape is

characteristic. In the female the eighth sternite is rather shallowly emarginate in the middle. The length varies from 5 to 6.25 mm.

TYPES.—Holotype, male, Birtle, Manitoba, August 3, 1928 (R. D. Bird); allotype, female "Wisconsin" (Wheeler Collection). Paratypes: male, Glen Souris, Manitoba, September 3, 1923 (H. A. Robertson); male and female, Maryfield, Saskatchewan, August 31, 1916 (N. Criddle); female, Bottineau, N. D., August 22, 1923 (H. A. Robertson); female, Saskatoon, Saskatchewan, June 5, 1922 (N. J. Atkinson); female, Strathclair, Manitoba, August 5, 1923 (H. A. Robertson); female, Port Hope, Ontario (W. Metcalfe). Paratypes in the Canadian National Collection.

AMERICAN MUSEUM NOVITATES

Number 518 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | March 26, 1932

59.9,81 L (69)

A NEW LEMUR FROM MADAGASCAR

BY RICHARD ARCHBOLD

Among the lemurs collected by the Mission Zoologique Franco-Anglo-Americaine in Madagascar, there are eighteen specimens of an apparently undescribed subspecies of *Lemur fulvus* Geoffroy. This subspecies I name in honor of Dr. L. C. Sanford, who helped so largely to make the expedition a success.

Lemur fulvus sanfordi new subspecies

TYPE.—No. 100585, Amer. Mus. Nat. Hist.; male adult; Mt. D'Ambre, Madagascar; October 17, 1930; collectors, Rand and DuMont. Skin and skull.

DISTINGUISHING CHARACTERS.—This lemur can be distinguished from all the black-nosed lemurs, except *Lemur fulvus rufus* (Audebert), by its lighter color, and from the latter by the cheek and ear tufts, in which it resembles *Lemur macaco* Linnæus.

RANGE.—This form is restricted to the rain forest of Mt. D'Ambre, northern Madagascar.

MALE (type).—Nose black; forehead dark gray in center, grizzled with reddish black. Top of head dark olive-buff; the remaining upperparts, except rump, root of tail, tail, wrists, ankles, hands and feet, snuff-brown to drab. Hands russet, gradually changing on wrists to color of back. Nails black and covered with long hairs that come from second phalanx and extend beyond nails. Spot at root of tail and proximal half of tail, bay-colored. In the apical half of the tail the hairs are long, giving it a bushy appearance; the tips are blackish brown, proximal to which is a clay-colored band that shows through prominently. Hairs of lips reddish black. A ruff of long hairs, which extends around ears and down the cheeks to the throat, varies in color from white to light ochraceous-buff; rest of underparts, except scrotum, varying from pale gull-gray to deep gull-gray, and washed with ochraceous buff. Scrotum blackish brown.

FEMALE.—Similar in color to the male, but lacking the variety. There are no cheek-tufts and the spot at the root of tail has a tendency to be less noticeable or lacking.

SKULL.—Similar to that of *Lemur fulvus albifrons* Geoffroy, but having less frontal swelling.

MEASUREMENTS (of type, taken in the flesh).—Total length, 895 mm.; tail, 495; length of hind foot, s. u., 107; ear height from orifice, 37. Skull: greatest length, 89.4; basal length, 75.6; length of nasals, (?) 25.9; zygomatic breadth, 51.5; least interorbital breadth, 16.7; palatal length, 38; length of upper molar tooth row, 16.4; breadth of palate across M-3, 28.0; length of mandible, 59.

AMERICAN MUSEUM NOVITATES

Number 519 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | March 31, 1932

59.57, 72 S (801)

NEW AMERICAN SYRPHIDÆ (DIPTERA), WITH NOTES

BY C. H. CURRAN

During a recent visit of Dr. C. L. Fluke to The American Museum of Natural History I had called to my attention a number of interesting species of Syrphidæ, including several described species that I had not seen before, as well as several new forms. In the following pages I present descriptions of several new species and notes on others. The types of the new forms are deposited in the Museum Collection.

Mixogaster cubensis, new species

Related to *breviventris* Kahl but with longer and much narrower second abdominal segment. Length, 9 to 12 mm.

MALE.—Head reddish yellow; a large spot on either side of the lower part of the front, a triangle extending from the ocelli to the vertex and the occiput, except above and below, black; the ocellar area sometimes surrounded by a large brown spot. A median facial vitta and a supra-antennal rectangle wine-red, the lunula black. Occiput cinereous pollinose. Hair yellowish, black on the front, the sides of the front sometimes broadly yellow-haired above, the middle with a broad, transverse bare band. Face almost perpendicular, with a convexity just below the antennæ, the lower half very gently convex. Third antennal segment as long as the face, twice as long as the basal two segments combined, rather strongly constricted on the sub-basal third; first and third segments brown, the second and basal half of the third reddish yellow; arista reddish yellow, much shorter than the third antennal segment. Front a little wider than the face.

Mesonotum brown, the sides broadly yellow; pile reddish yellow, mostly black on the dark portion behind the suture. Pleura brownish red; the mesopleura mostly, a very large sternopleural spot, and most of the hypopleura yellow. Pectus and metanotum brownish black. Scutellum wholly yellow, with short, sparse, reddish-yellow hair.

Legs reddish yellow, the coxæ, trochanters, and broad bases of the femora brownish. Hair reddish yellow.

Wings with luteous tinge, yellowish brown in front of the third vein, the apex darker, the costal cell paler. Apex of the apical cell almost transverse, the discal cell about as long behind as anteriorly, the posterior cross-vein conspicuously curved inward and somewhat angular on its middle portion, sometimes emitting a stump of vein into the discal cell; usually a stump of vein projecting into the apical cell from the fourth vein a little before the end of the discal cell. Squamæ linear, brown. Halteres reddish.

Abdomen black, ferruginous, and yellow. First and second segments fused, ferruginous, the first broadly yellow on the sides, the second with the apex broadly yel-

low; third segment with the apical third or more, yellow; the fourth with a broad, apical, pale band. Genitalia broadly yellow apically, brown above and below. Hair black, reddish yellow on the pale portions and the broad apex of the abdomen. Venter concolorous with the dorsum. Second abdominal segment narrowest at the middle, gently widening toward either end, third widening from the base to the apical third, the fourth with almost parallel sides. Second and fourth segments of about equal length, much longer than the third.

FEMALE.—Face less distinctly convex above; third antennal segment somewhat shorter and broadened on less than the apical half; second abdominal segment shorter and widening from near the base, the fifth segment with a yellow posterior border.

TYPES.—Holotype, male, Sierra Maestra, Cuba, July 10–20, 1922 (C. H. Ballou and S. C. Bruner); allotype, female, Santa Barbara, Isle of Pines, March 15, 1923 (S. C. Bruner). Paratypes: male, Sierra Maestra, July 10–20, 1920, and male, Pico Turquino, Cuba, July 20, 1922 (S. C. Bruner and C. H. Ballou).

ALLOGRAPTA Osten Sacken

The following key separates the species known to me.

TABLE OF SPECIES

1.—Pteropleura black on lowest two-thirds or more. . . . . .2.
A yellow band extends over the upper part of the sternopleura, lower part of the pteropleura, and on to the hypopleura . . . . *obliqua* Say.
2.—Disc of the scutellum with a large, transverse, posteriorly convex black or brown spot. . . . . .3.
Disc of scutellum but slightly darkened. .7.
3.—Tip of the oral margin lying far above the lower edge of the eyes and considerably more prominent than the antennal base. . . . . 4.
Tip of oral margin situated only a little above the lower edge of the eyes and less prominent than the weak tubercle and base of the antennæ. . . . . .5.
4.—Hair of the anterior tibiæ wholly black; yellow fascia on the third abdominal segment separated from the base of the segment by at least its own width. *colombia* Curran.
Hair of anterior tibiæ practically all yellow; yellow fascia on third segment only narrowly separated from the base of the segment. . . *similis* Curran.
5.—Squamæ brown except basally; front of male black pilose. .*fuscisquama* Curran.
Squamæ at most slightly infuscated; front of male usually almost all yellow pilose. . . . . .6.
6.—Black median spots on the bases of the third and fourth abdominal segments triangular. . . . .*venusta* Curran.
These spots almost orbicular, a little longer than wide. . . . . *cubana*, n. sp.
7.—Oral margin more prominent than the antennal base, the face projecting forward below and with a conspicuous tubercle; abdomen fasciate only. . . . . .8.
Oral margin not more prominent than the antennal base, the tubercle low and never conspicuous; abdomen with oblique spots on at least the fourth segment. . . . . .10.
8.—Hypopleura wholly dark. . . . . .9.
Hypopleura with a large, pale-yellow spot. . . . . *picticauda* Bigot.

9.—Fifth segment with four yellow spots..... .... .*micrura* Osten Sacken.
Fifth segment with an arched yellow fascia. . ... *fasciata*, n. sp.
10.—Cheeks with a black band across the middle.... ....11.
Cheeks wholly yellow. .. ..*pulchra* Shannon.
11.—Third abdominal segment with a geminate, median, yellow vitta.
exotica Wiedemann.
Third segment with only one pair of oblique or nearly parallel yellow spots...12.
12.—Pale spots on the third abdominal segment strongly oblique...*hortensis* Philippi.
Pale spots subparallel. . . .. *piurana* Shannon.

Allograpta cubana, new species

Related to *venusta* Curran, but the black median spots on the third and fourth abdominal segments are short-oval or orbicular instead of triangular and are not produced posteriorly in the middle. Length, 7 to 7.5 mm.

MALE.—Face, cheeks, and broad borders of the frontal triangle pale yellow; a broad median facial vitta, a band on the cheeks, and most of the frontal triangle shining black. Vertical triangle and occiput black, the latter cinereous-white pollinose. Pile yellowish, white on most of the occiput, black on the vertical triangle and at least partly black on the frontal triangle. Oral margin less prominent than the antennal base. Antennæ reddish, the third segment broadly black above; arista brown.

Thorax shining black, with yellow markings as follows: the very broad lateral margins in front of the suture, the posterior calli, broad posterior border of the mesopleura except below, a smaller spot on the sternopleura, and a spot occupying the anterior part of the hypopleura. Scutellum yellow, with an oval, transverse black spot on the disc. Pile yellow, mostly black behind the suture and on the scutellum.

Legs yellowish; a very broad preapical black band on the posterior femora, a corresponding band basally on the posterior tibiæ, and the apical third of the posterior tibiæ black; tarsi brown. Pile pale yellow, black apically on the posterior femora and toward the apex on the posterior surface of the anterior four; wholly black on the posterior four tibiæ, on the posterior surface of the anterior pair, and on all the tarsi.

Wings hyaline; stigma scarcely darkened. Squamæ yellowish. Halteres yellow.

Abdomen reddish yellow and black. First segment yellow with the narrow posterior border black toward either side. Second segment black with the median third yellow, the pale fascia narrowed toward the middle and narrowly bordered with opaque black Third segment with a large black basal triangle on either side, a suborbicular median basal spot, and a broad posterior fascia black, the black fascia narrowed laterally and biconcave medianly in front; the lateral black spots are opaque on their inner borders, the median one wholly opaque, the posterior fascia opaque in front. Fourth segment practically like the third anteriorly but the posterior black fascia is broken up to form a narrow median vitta and a black triangle on either side. The fifth segment bears a median black vitta and a narrow black posterior triangle in addition to large lateral triangles which do not reach quite to the base of the segment although they are wider in front. Hair short and black, longer on the sides, pale on the base of the abdomen, on the sides of the first two segments, and sometimes basally on the lateral margins of the third and fourth. Genitalia shining black. Venter yellowish.

TYPES.—Holotype and paratype, males, E. E. A. de Cuba, No. 9583, feeding on Chermidæ.

In some respects this species agrees with the description of *Syrphus radiatus* Bigot, and the two names may eventually be found to apply to the same species. Bigot does not mention the black facial vitta.

Allograpta fasciata, new species

Related to *micrura* Osten Sacken but readily distinguished by the much more produced face and entire fascia on the fifth abdominal segment. Length, 9.5 mm.

FEMALE.—Face, cheeks, and the sides of the front on the lowest two-fifths yellow; a broad, median, facial vitta black; a yellow band extending across at the bases of the antennæ. Hair whitish; front shining blue-black, with black pile; occiput thickly cinereous-white pollinose. Cheeks wide behind, narrow in front, the oral margin oblique in profile. Face very strongly produced below, the oral angles and the tip of the anterior oral margin in a vertical plane; tubercle prominent. Antennæ widely separated, reddish, the third segment broadly brown above; arista blackish.

Thorax metallic blackish-blue, the mesonotum somewhat dulled. Humeri, posterior calli, a narrow stripe on the posterior border of the mesopleura, and a large spot on the upper border of the sternopleura yellow; scutellum dull reddish-yellow, black-haired, the free border dull black below. Pile whitish, a few scattered black hairs on the posterior half of the mesonotum.

Legs reddish yellow, the coxæ and tarsi brown, the anterior four tarsi rather paler basally. Hair pale yellowish, the femora with a few blackish hairs apically, the posterior tibiæ with a row of long black hairs anterodorsally; tarsi with short, black hair above on the apical three or four segments.

Wings cinereous hyaline. Squamæ and halteres yellowish.

Abdomen black, with four reddish-yellow fasciæ, the posterior three rather strongly arched. Sides of the first segment yellow in front. Pale fascia on the second segment situated near the middle, widest laterally, almost straight in front. Pale fasciæ on the third and fourth segments rather strongly arched, somewhat widened laterally, well separated from the anterior margin of the segments; band on the fifth segment resting on the anterior margin on the median portion. All the fasciæ are separated from the lateral margin of the abdomen and have the outer ends more or less convex; apex of the fifth segment narrowly reddish yellow. Sixth and seventh segments wholly black. Hair black, yellowish on the broad base of the abdomen. Venter reddish yellow, yellow pilose.

TYPE.—Female, "Peru."

This species, as well as *micrura* Osten Sacken and *picticauda* Bigot, is not typical of *Allograpta*, but they all fit in this genus better than in *Sphærophoria*. In these three species the lower part of the head is produced as in *Sphærophoria*, but the males do not have enlarged genitalia. Like the genus *Claraplumula* Shannon, all the species of *Sphærophoria* and *Allograpta* have the metasternum pilose, and it should be pointed out that this character occurs in species of *Syrphus*, *Epistrophe*, and other genera. *A. fasciata* must resemble species of *Fazia* Shannon,

but it does not appear to belong to the genus as originally defined. In addition to these three American species there are some other forms, occurring in the Australasian and Oceanic regions, that are referable to *Allograpta*, if the generic concept is widened to include *micrura*, etc., as I think it should be.

SALPINGOGASTER Schiner

I present a key to the described species belonging to this genus.

TABLE OF SPECIES

1.—Face wholly yellow.......................................2.
Face with black or dark-reddish median vitta or with a black spot above... 11.
2.—Yellowish or rusty reddish species..............................3.
Blackish species, the pleura and abdomen not simultaneously yellowish.....6.
3.—Pleura blackish or ferruginous with a broad yellow band between the humeri and the middle coxæ.......................................19.
Pleura yellow with narrow brownish stripes..............................4.
4.—Mesonotum ochre-yellow with three dull-black vittæ........*minor* Austen.
Mesonotum blackish or with brownish-yellow pollen and two grayish vittæ.. 5.
5.—Frontal triangle wholly yellow........................*frontalis* Sack.
Frontal triangle largely black..18.
6.—Legs shining black, the apex of the femora and basal third of the tibiæ whitish. *macula* Schiner.
Legs differently colored..7.
7.—Thorax and legs brownish red, with yellow markings; abdomen black. *nova* Giglio-Tos.
Thorax black or brown; if marked with yellow, the legs yellow; always partly or wholly yellowish..8.
8.—Abdomen shining black or brown, except the first segment..............10.
Abdomen reddish with brown markings, or yellow with black apex..........9.
9.—Abdomen reddish with brown markings................*cothurnata* Bigot.
Abdomen with the basal four segments yellow, the apical ones black. *nigricauda* Sack.
10.—Mesonotum chocolate-brown, with two dull-yellow vittæ; abdomen black, the first segment yellow...............................*abdominalis* Sack.
Mesonotum dull black, with three yellow vittæ; second to fourth segments with yellow spots...................................*nigriventris* Bigot.
11.—Facial tubercle reddish, sometimes flecked with black...................12.
Facial tubercle or a spot above, black....................................15.
12.—Abdomen, from lateral view, suddenly widened at the third segment. *bicolor* Sack.
Abdomen slender..13.
13.—Mesonotum with two yellow, U-shaped markings before the scutellum. *gracilis* Sack.
Mesonotum without such markings...14.
14.—Scutellum wholly rusty reddish............................*bruneri*, n. sp.
Scutellum yellow, the basal half brown or black..............*texana*, n. sp.

15.—Pleura and legs yellow. .... *costalis* Walker.
Pleura black with yellow markings. ... ... 16.
16.—Scutellum black on the disc. . . . . 17.
Scutellum wholly yellowish .... *lineata* Sack.
17.—Basal third of tibiæ whitish .... *nigra* Schiner.
Basal third of tibiæ black or brownish...... .... . . *limbipennis* Williston.
18.—A narrow brown vitta extending from base of second segment to apex of abdomen; front of female with two roundish spots near the middle. *bipunctifrons* Curran.
Abdomen not vittate........ . . .. *virgata* Austen.
19.—Pleura ferruginous; fifth sternite of male beset with spinules. *punctifrons* Curran.
Pleura blackish; fifth sternite not spinose..... .... *pygophora* Schiner.

Salpingogaster bruneri, new species

Pale rusty reddish; wings with a brown fascia across the middle. Length about 16 mm.

MALE.—Face, cheeks, and frontal triangle yellow; the frontal triangle, except on the very broad orbits, and a broad facial vitta, which does not extend below the tubercle, pale reddish-brown. Vertical triangle reddish yellow, the ocellar triangle brown; occiput black in ground color, cinereous pollinose. Hair yellow; short and black on the frontal and vertical triangles. Antennæ pale brownish-red.

Mesonotum rusty reddish, with a pair of posteriorly abbreviated, narrow vittæ and the notopleura black, the lateral margins broadly yellow in front of the notopleura. Pleura pale ferruginous, darker above; a broad stripe extending from the upper edge of the mesopleura to the middle of the sternopleura and a large, suboval spot on the hypopleura pale yellow. Scutellum wholly reddish. Hair very short, brownish yellow.

Legs reddish; coxæ ferruginous; posterior femora with a broad, obscure, brownish preapical band; posterior tibiæ black on the apical third; tarsi wholly pale.

Wings hyaline, with yellowish tinge; costal border rather broadly luteous, the apical fifth brown; a rather narrow brown fascia extends across the middle of the wing over the cross-veins, its outer edge gently concave, the inner edge convex.

Abdomen long and slender, the second segment almost as long as the remaining segments combined, wholly rusty reddish except the basal half of the first segment and a broad, obscure pale-yellowish band near the basal fourth of the second segment. Base of the first segment very strongly produced to form a mammiform process on either side. Hair yellowish basally and on the sides of the abdomen, brownish dorsally and on the whole of the apical segments. Apex of the genitalia acutely produced. Median half of the fifth sternite strongly produced downward apically, the apex of the produced part shallowly emarginate, the sternite without coarse setulæ.

TYPE.—Male, Sierra Maestra, Cuba, 600 to 900 meters, July 10–20, 1922 (C. H. Ballou and S. C. Bruner).

Salpingogaster texana, new species

Blackish, the face, thorax, and abdomen with yellow markings, third vein rather shallowly looped into the apical cell; costal border brown on the basal three-fourths. Length, about 13 mm.

FEMALE.—Face, cheeks, and front reddish ferruginous, the orbits broadly yellow; upper fifth of the front shining brown; face with white pollen, the tubercle bare; front with weak, oblique wrinkles except above and below; occiput black in ground color, cinereous pollinose. Hair short, whitish, black on the sides of the antennal tubercle and the brown part of the front. Antennæ brownish red, the third segment mostly brown.

Thorax brownish ferruginous, the mesonotum black, the sides broadly ferruginous and with a posteriorly tapering yellow vitta extending from the humeri to the inner end of the notopleura; a slender median gray-pollinose vitta extends from the anterior margin, becoming obsolete posteriorly where there is evidence of a rectangular, ferruginous, prescutellar spot. Scutellum brown with about the apical half yellow. A narrow yellow stripe occupies the posterior border of the mesopleura and ends below in a large spot on the sternopleura.

Legs ferruginous or blackish, the tips of the femora and the basal fourth of the tibiæ yellow.

Wings hyaline, the costal border brown on the basal three-fourths, the cross-veins at the middle of the wing, the base of the wing and the posterior border of the second basal cell brownish. Squamæ white. Halteres reddish.

Abdomen black, the second segment reddish brown; first segment with the sides yellow in front, not strongly produced; third segment with a laterally widening basal yellow fascia which is separated from the base of the segment on the median half; sides of the fourth and fifth segments very narrowly yellow on the basal half or less; narrow apices of the third and fourth segments yellow. Venter blackish or brownish, with a yellow fascia on the base of the third sternite. Hair short, black, pale basally and on the sides of the first four segments.

TYPE.—Female, Brownsville, Texas, February 11, 1915 (P. H. Timberlake), larva feeding on *Dactylopius confusus*.

This species appears to connect *Salpingogaster* and *Baccha* Fabricius, but it fits better in the former. The dip of the third vein into the apical cell is much shallower than in any of the other species of *Salpingogaster*, but the shape of the head and other characters, especially the presence of setæ on the under surface of the posterior femora, indicate its true affinities.

Pocota bomboides Hunter

HUNTER, 1897, Can. Ent., XXIX, p. 141.

Doctor C. L. Fluke has brought to my attention two specimens of this species from Oregon, in which the first to third abdominal segments are reddish-yellow pilose, the only black pile on the dorsum of the abdomen being restricted to the apex of the fourth segment in the male and to the fifth segment in the female. Both these specimens have the scutellum yellow pilose, and the female has a narrow, yellow pilose prescutellar band. In another Oregon specimen the scutellum has black and yellow pile intermixed. In most specimens of *bomboides* the scutellar pile is all black, and the abdomen bears yellow pile only on the fourth segment.

The genitalia of the three forms mentioned above show no differences, and it is safe to say that the specimens represent the extremes of variation in color of the pile.

I have seen specimens from California, Oregon, Washington, and British Columbia.

Sphecomyia Latreille

For some strange reason *Tyzenhauzia vespiformis* Gorski has been placed as a synonym of *Chrysotoxum vittatum* Wiedemann, and since 1862 the European species has been recorded as *vittatum*. In North America there are five described species of *Sphecomyia*, one of which, *vespiformis*, was originally described from the Palæarctic region and later from America as *brevicornis* by Osten Sacken. Apparently all European records of *vittata* refer to *vespiformis*.

The following key separates the described species.

Table of Species

1.—Mesonotum with two interrupted yellow pollinose vittæ; disc of scutellum yellow pollinose, the apical border bare . . . . 2.

Mesonotum without vittæ; scutellum mostly shining . . . . 3.

2.—Black median fasciæ on third and fourth abdominal segments interrupted to form two transverse spots and a median diamond-shaped spot (*brevicornis*. Osten Sacken) . . . . *vespiformis* Gorski.

Black median fasciæ entire, the preceding yellow fascia obscurely interrupted in the middle . . . . *vittata* Wiedemann.

3.—Scutellum with the base yellow pollinose . . . . *pattoni* Williston.

Scutellum without pale pollen . . . . 4.

4.—Mesonotum with a yellow prescutellar fascia . . . . *occidentalis* Osburn.

Mesonotum wholly shining black behind the suture . . . . *nasica* Osburn.

Meromacrus potens, new species

Related to *cinctus* Drury but larger, the scutellum black in ground color and with longer, reddish-yellow pile, the abdomen with mostly yellow and tawny hairs. Length, 19 to 21 mm.

Male.—Head black in ground color; sides of the frontal triangle, lateral third of the face, occiput, and the vertical triangle in front of the ocelli whitish pollinose; middle of face and front, and the cheeks, shining black. Pile black, the occiput on the lower two-thirds, cheeks in front and behind, face, and the sides of the front, with white pile. Antennæ blackish.

Thorax black, the mesonotum dull; humeri with brownish-gray pollen. Yellow tomentose markings as follows: a pair of large, subtriangular spots on the front margin inside the humeri, the notopleura and a contiguous spot on the mesopleura and a prescutellar fascia. Pile black, rather sparse, yellowish dorsally in front of the suture and on the scutellum, although there may be a few scattered black hairs on the latter.

Legs black; posterior femora strongly swollen, very gently concave below, with a large, strong tubercle posteroventrally near the base; hair on middle femora extremely dense on the basal third of the anterior surface.

Wings cinereous hyaline, the anterior third pale brownish, the veins more or less bordered with brownish. Squamæ cinereous or pale brownish, the border, fringe, and pubescence yellowish.

Abdomen black or brown, the fourth segment mostly metallic blue, the second with a broadly interrupted brownish-red fascia, the inner ends of the spots formed obtuse, the posterior edges oblique but not reaching the posterior border of the segment, the outer ends produced and reaching the base of the segment broadly at the sides. Third segment brown with a broad band of short, dense, yellow pile on the base, the fascia gently widening to the lateral margin and very narrowly interrupted in the middle. Fourth segment metallic blue, the sides with dense, yellow pile. Genitalia shining bluish. First segment, second except the sides and extreme apex, and the third except the extreme apex, tawny or rusty reddish pilose, the sides of the first and second, apices of the second and third, the fourth segment except the sides, and the genitalia black pilose. Venter black pilose apically, pale basally.

FEMALE.—Front black, black-haired, the sides narrowly white pollinose and pilose to above the middle. Mesonotum with four grayish vittæ, the suture of the same color. Posterior femora smaller; legs without the dense pile. Yellow pilose spots on the fourth abdominal segment limited to the basal half; fifth segment steel-blue.

TYPES.—Holotype, male, B. de Joaquin, Sierra Maestra, Cuba, July 10–20, 1922 (C. H. Ballou and S. C. Bruner); allotype, female, Sierra Maestra, July 10–20, 1922 (Ballou and Brunner); paratype, male, same data.

I have adopted the manuscript name appended to the male, for this species. At first glance the species appears to differ from *cinctus* Drury only by its larger size, but *cinctus* shows no trace of the mesonotal vittæ, the color being uniform and rather velvety, and a comparison shows many other differences. As a key to the species will be published elsewhere in the near future I do not present one in this paper.

AMERICAN MUSEUM NOVITATES

Number 520 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | April 8, 1932

59.87, 4 C (93)

BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XIX[1]

NOTES ON THE BRONZE CUCKOO *CHALCITES LUCIDUS* AND ITS SUBSPECIES

BY ERNST MAYR

The Whitney Expedition has collected a series of Bronze Cuckoos in the Solomon Islands and also some specimens on Rennell Island. When reporting on this latter collection,[2] I lacked material from New Zealand and Australia, and was not able to identify the specimens with certainty. The males I called provisionally *Chalcites lucidus lucidus* and the females *Chalcites lucidus plagosus*, as the descriptions fitted best this way. However, certain color characters and the small size of the specimens made me suspect that Rennell Island had an endemic subspecies of this cuckoo, and in order to clear up the question, I decided to undertake a revision of this difficult group. The Zool. Museum in Tring, the U. S. National Museum in Washington, and the Museum of Comparative Zoölogy in Cambridge kindly loaned me their specimens, and I am much indebted to Lord Rothschild, Dr. Herbert Friedmann, and Mr. James L. Peters for access to this material.

All the measurements are in millimeters; tail and wing are measured as described in my previous papers; the bill is measured by dividers from the nostril to the tip; the culmen from the base to the tip; the width of the maxilla is measured just before the nostrils.

The differences between *lucidus* and *plagosus* that are given in the last revision of the genus[3] are not complete and are partly misleading, and the identifications of the material in most collections are far from correct. For example, all the specimens from the Solomon Islands identified as *plagosus*, which I was able to examine, turned out to be typical *lucidus*, and several New Guinea and Australian specimens, identified as *lucidus*, turned out to be *plagosus*. It was therefore necessary for me first to work out the characters of these forms. This task was made more difficult by the doubtful sexing of most of the specimens.

[1]Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, 469, 486, 488, 489, 502, 504, and 516.
[2]1931, Amer. Mus. Novit., No. 486, p. 14.
[3]Hartert E., and Stresemann, E., 1925, Nov. Zool., XXXII, p. 159.

Although it is said in all the previous descriptions that males and females are identical, I have some evidence for a sexual dimorphism in color.

Another interesting feature of this species is that two of its subspecies are migratory, while two others are sedentary. More remarks about the migration will be made in connection with *lucidus* and *plagosus*.

Chalcites[1] lucidus lucidus (Gmelin)

Cuculus lucidus GMELIN, 1788, 'Syst. Nat.,' I, pt. I, p. 421, Queen Charlotte Sound, New Zealand.

Cuculus nitens FORSTER, 1844, 'Descript. Anim.,' p. 151 (new name for the same bird.)

?*Lamprococcyx lucidus australis* MATHEWS, 1916, Bull. Brit. Orn. Club, XXXVI, p. 83, Capricorn Islands, Queensland.

SUBSPECIFIC CHARACTERS.—Bill very much broader than in *plagosus*, especially at the base; forehead, lores, supercilium, cheeks and ear-coverts with much white. Crown and hind neck not pure purple-bronze, but always with some greenish reflections; bars on underside more greenish, less bronze; throat not so broadly barred; white spots and bars on outermost tail-feather (V) pure white, not washed with rufous or russet, white tip usually extending to outer web; on the fourth tail-feather (next to the outermost) one or two reddish spots, mostly small, sometimes barely indicated, but seldom entirely missing.

FEMALE CHARACTERS.—Females have the broad bill of the males, but approach *Ch. l. plagosus* in several characters of coloration. Crown and hind-neck are much more purplish bronze, the bars on the underside also less greenish; the rusty spots on the fourth tail-feather in females are usually larger than in males.

IMMATURE.—I have no nestling, but have several immature birds, which show the following characters: Base of mandible yellowish; wing-coverts with buffy or cinnamon edges; bars on sides of head, throat and breast dull grayish-brown, rarely with a slight greenish gloss; white bars and spots on two outer tail-feathers much wider.

		WING	TAIL	BILL[2]	CULMEN[3]
New Zealand	7 ad.	102-105(103.7)	67-70(68.7)	11-12(11.4)	18-20(18.9)
Chatham Islands	2 ad.	106, 107	70, 70	12, 12	20
Lord Howe Isl.	1 ♂ ad.	104	69	11.5	19
Norfolk	1 ♀ imm.	100	66	11	19
Solomon Islands[4]	3 ♂ ad.	molt.	68, 70	11, 11, 12	18, 18, 19.5
Solomon Islands[4]	3 ♀ ad.	104, 105	67, 68, 69	11.5, 11.5, 12	19, 19, 19.5
Solomon Islands[4]	2 ♀ imm.	98, 101	molt.	11, 11.5	18.5, 19

RANGE.—Breeding on New Zealand and Chatham Islands. Possibly breeding on Norfolk and Lord Howe Islands. Wintering in

[1]The difference between *Chalcites* Lesson, 1830 (Oriental species) and *Chrysococcyx* Boie, 1826 (African species) consists mainly in the barring of the wing *Chalcites* has only a single oblique white or pale rufous bar

[2]From nostril.

[3]From base

[4]Weight: 23, 25, 28, 34

the Solomon Islands, on Nissan, Feni, and possibly the Bismarck Archipelago.

Information concerning the winter quarters and migration routes of this bird is scanty and uncertain. In his recent book, Oliver[1] writes: "Supposed to winter in some of the islands of the Pacific, but localities unknown. Visitor to Lord Howe and Norfolk Islands. The migration route of the shining cuckoo is unknown:" He had overlooked, however, the information given by Hartert and Stresemann[2]: "Found migrating and wintering in Eastern Australia, Eastern New Guinea, and the Solomong Islands." The correctness of this statement is somewhat doubtful, all the Australian specimens of Bronze Cuckoos identified as *lucidus* that I have seen, turn out to be typical *plagosus* on closer examination. However, I have not seen any one of the birds that served Mathews as material when he described his "*Lamprococcyx lucidus australis.*" It is quite possible that some of these birds, collected on the Capricorn Islands off the coast of Queensland, were typical *lucidus*. All the New Guinea specimens I have seen are also *plagosus*, with the single exception of an immature male, collected by Meek on Woodlark Island (on April 10, 1897). This bird has a narrow bill, but agrees otherwise rather well with immature *lucidus*. I have seen no specimens from the Bismarck Archipelago, but I notice that Hartert records a specimen of *lucidus* from Feni Island (southeast of New Ireland)[3] and three specimens from New Britain.[4]

The Solomon Islands seem to be the regular winter quarters of this subspecies, and only of this, not of *plagosus*. All the supposed specimens of *plagosus* from the Solomon Islands, which I have had an opportunity to examine, are typical *lucidus*. It may be useful to record here all the previous records of this subspecies from the Solomon Islands:

Chalcites plagosus, Ramsay, 1879, Proc. Linn. Soc. N.S.W., IV, p. 70 (Savo, Cockerell coll., 2 specimens); Tristram, 1882, Ibis, p. 138 (Russell Island, Richards coll.).

Lamprococcyx basalis, Ogilvie-Grant, 1888, Proc. Zool. Soc., p. 191 (Guadalcanar, Woodford coll., 2 ♂, 2 ♀).

Chalcococcyx malayanus, Shelley, 1891, 'Cat. Birds Brit. Mus.,' XIX, p. 298 (erroneous name, based on preceding quotation).

Chalcococcyx plagosus, Shelley, 1891, 'Cat. Birds Brit. Mus.,' XIX, p. 297 (no additional material); Rothschild and Hartert, 1901, Nov. Zool., VIII, p. 376 (Guadalcanar, Meek coll., 3 specimens; Woodford coll., 1 specimen); idem, 1902, Nov. Zool., IX, p. 586 (Ysabel, Meek coll., 1 ♀); idem, 1905, Nov. Zool., XII, p.

[1]Oliver, W R B, 1930, 'New Zealand Birds,' p. 423.
[2]1925, Nov. Zool, XXXII, p. 159
[3]Nov Zool, XXXIII, p 39.
[4]Ibid., p. 136.

258 (Bougainville, Meek coll., 1 ♂); idem, 1907, Nov. Zool., XIV, p. 439 (further details and corrections).

Chrysococcyx plagosus, ROTHSCHILD AND HARTERT, 1908, Nov. Zool., XV, p. 356 (Vella Lavella, Meek coll., 1 ♀).

Chalcites lucidus lucidus, ROTHSCHILD AND HARTERT, 1907, Nov. Zool., XIV, p. 439 (corrected identification of the Bougainville specimen mentioned above); HARTERT AND STRESEMANN, 1925, Nov. Zool., XXXII, p. 159 (revision); HARTERT, 1926, Nov. Zool., XXXIII, p. 39 (Feni Island, Eichhorn coll., 1 ♀); idem, ibid., p. 45 (Nissan Island, Eichhorn coll., 1 ♂).

Not counting the two specimens from Feni and Nissan, this list contains thirteen records of *Ch. l. lucidus* from the Solomon Islands. Of the birds identified as *Ch. plagosus* I have seen two, one from Guadalcanar and one from Vella Lavella (both Meek coll.), and both are typical *lucidus*.

The Whitney Expedition collected 6 specimens:

3 ♂ ad.	Buin, Bougainville,	24–27, July 1929
1 ♀ imm.	" "	21, July, 1929
1 ♀ ad.	Choiseul,	25, Sept., 1929
1 ♀ imm.	Gizo,	30, May, 1928

There are now nineteen specimens of *Chalcites lucidus lucidus* known from the Solomon Islands, enough evidence to show that they are regular winter quarters of this subspecies.

TIME OF MIGRATION.—According to all reports[1] the bird starts to leave New Zealand in the latter part of January, its main migration month is February, and the last birds leave in March and the first part of April. Occasionally an individual winters in New Zealand; there are records from May, June and July. The return migration begins in the middle of September (first record Sept. 7) and reaches its height during October. One bird was killed on Nov. 5 at the East Cape Lighthouse which is the last definite migration date. These New Zealand dates correlate very well with the dates of the birds collected in their winter quarters in the Solomon Islands. The earliest date is March 16, 1908 (Vella Lavella Isl., Meek.); the latest date is September 25, 1929 (Choiseul Isl., Hamlin and Mayr). Of eighteen birds of which I know the collecting dates on the Solomon Islands and Nissan-Feni, one was collected in March, three in April, six in May, two in June, four in July, none in August and two in September. No specimen of *Chalcites lucidus lucidus* (Gmelin) was taken in the Solomon Islands during the period from October to February, although the Whitney Expedition, as well

[1]See 1910, Trans. Proc. New Zealand Inst., (1909), pp. 392–408; 1929, Emu, XXVIII, p. 220; 1930, Oliver, 'New Zealand Birds,' p. 423.

as other expeditions, were actively engaged in collecting during that period.

Migration Route.—Nothing is definitely known about the migration route these birds take. On their way from New Zealand to the Solomon Islands these birds could travel either via New Caledonia and the New Hebrides, or via the Australian coast and eastern New Guinea. For the former route, which would be nearer and more direct, there is no evidence. All the specimens collected in New Caledonia and the New Hebrides are *layardi.*

On Norfolk and Lord Howe Islands, the bird is only a visitor according to Oliver (*loc. cit.*, p. 423), but breeds there according to Mathews.[1] This is quite possible, as warblers (*Gerygone*), the usual host of *Chalcites lucidus*, are present on both islands. A specimen from Lord Howe (♂ ad., Feb. 12, 1915, Bell coll.) and a specimen from Norfolk (♀ imm., March 28, 1913, Bell coll.) were both collected during the migration period. They are in every respect similar to typical *Ch. l. lucidus* (Gmelin).

I do not know of any authentic specimens of *Ch. l. lucidus* from Australia, but I accept, with some reservation, the correctness of the identification of the specimens collected on the Capricorn islands[2] during the middle of October (9–18). More evidence is required before the Australian coast can be definitely established as the regular migration route of *Chalcites lucidus lucidus* from New Zealand to the Solomon Islands.

The migration of this species is very amazing, and requires a perfect functioning of the entire "instinct" apparatus. At the end of January and in February, the adult birds depart for their winter quarters. On the average the young birds depart, according to many reports from New Zealand, later than the adults. Nobody shows them the migration route, as their foster parents (*Gerygone* and *Rhipidura*) are sedentary. Still, they leave and fly 1200 miles across the sea to Australia, if they do not strike Lord Howe which is 900 miles distant from New Zealand. Still more remarkable, after having reached the tropical Queensland coast, they do not stop there, but start flying again across another 950 miles of ocean till they finally reach the Solomon Islands or the Bismarck Archipelago. The slightest error in the direction or in the strength of the migration-instinct, and they would never see land again, but would perish in the wide Pacific Ocean.

[1]1918, 'Birds of Australia, VII, p 352.
[2]1910, Emu, X, p 197

Chalcites lucidus plagosus (Latham)[1]

Cuculus plagosus LATHAM, 1801, 'Index Ornith.,' Suppl., p. 31, Nova Hollandia, restricted to New South Wales.

Cuculus metallicus VIGORS AND HORSFIELD, 1827, Trans. Linn. Soc. London, XV, p. 302, New South Wales.

Lamprococcyx poliurus SALVADORI, 1889, 'Ornit. Papuasia e Mol.,' Agg., p. 49, Tarawai Island, N. New Guinea.

Chrysococcyx plagosus tasmanicus MATHEWS, 1912, 'Austr. Avian Record,' I, p. 17, Tasmania.

Chrysococcyx plagosus carteri MATHEWS, ibid., p. 17, Broome Hill, South West Australia.

SUBSPECIFIC CHARACTERS.—Bill narrower than in *lucidus;* forehead, lores, supercilium, cheeks and ear-coverts with much less white than in *lucidus;* crown and hind neck pure purple-bronze, without any greenish reflections,[2] more narrowly barred on the underside, bars on throat conspicuous; bars on underside more coppery bronze, less greenish; white spots and bars on outermost tail-feather (V) often washed with rufous or russet, white tip usually not extending to outer web; on the fourth tail-feather (next to the outermost) usually two rufous bars and often a third rufous or whitish spot; pattern on this feather very variable, but usually with more rufous than in *lucidus*.

FEMALE CHARACTERS.—My material is not sufficient for me to say anything definite about the sexual dimorphism of this subspecies. Evidently part of my material is wrongly sexed.

IMMATURE.—Smaller, bill shorter, yellow at base; wing-coverts with buffy or cinnamon edges; gloss on head and hind neck greenish, instead of purple-bronze; wings and tail almost without gloss; sides of head and throat, and indistinct throat-band brownish gray. Throat and flanks barred with fuscous, in one specimen entirely whitish without any bars.

		WING	TAIL	BILL	CULMEN
Tasmania	2 ad.	104, 104.5	65, 65	11, 11.5	18, 18.5
Australia	15 ad.	102.5-108(104.9)	66-70(67.6)	10.5-12(11.1)	18-19.5(18.4)
Australia	2 imm.	97, 100	62, 65	10, 10.5	17, 18
New Guinea	3 ad.	103, 105, 107	66, 67	11, 11	18, 18.5

Width of the bill 4.2–5.0 (4.6) against 5.0–6.0 (5.5) in *lucidus*.

RANGE.—Tasmania and southern part of Australia. Wintering in the Lesser Sunda Islands (Lombok, Sumbawa, Flores, and Wetar), in New Guinea, and possibly in the Bismarck Archipelago.[3]

Three specimens from Tasmania (2 ad., 1 first-year plumage) agree with Australian birds in tail and bill, but have a slight greenish tinge on the hind neck. It is doubtful if this character, even if substantiated by

[1]*Sylvia versicolor* Latham, 1801, 'Index Ornith.,' Suppl., II, p. 56, has often been quoted a synonym. This is certainly wrong. If *versicolor* is a *Chalcites* at all, which is rather doubtful, it can be only the juvenal of *Chalcites basalis* Horsfield.

[2]Seen with the light.

[3]I have not seen enough material from the Bismarck Archipelago to decide which subspecies hibernates there.

more material, would be sufficient to recognize Mathews' *tasmanicus*, which name has been synonymized to *plagosus* by the author himself (1927, 'Syst. Av. Austral.,' p. 415).

Chalcites lucidus layardi (Mathews)

Chrysococcyx layardi Mathews, 1912, 'Austr. Avian Record,' I, p. 16, New Caledonia.

Type.—In the British Museum of Natural History.

Subspecific Characters.—Smaller than *lucidus* and *plagosus;* bill broad and strong, on the average even heavier than in *lucidus;* white on head very much reduced, no white on forehead, supercilium, upper cheeks and ear-coverts, but sometimes a few whitish feathers behind the eye; throat and sides of throat whitish, almost unbarred; breast, flanks and under wing-coverts also less strongly barred than in *lucidus* and *plagosus;* forehead, crown and sides of head dull purple, very little glossy; hind neck and fore-back bronze-purple, less glossy and more purplish than in *plagosus;* sides of breast frequently washed with cinnamon; pattern on tail entirely different from *lucidus* and *plagosus;* reddish (tawny) colors very much extended; on the fifth (outermost) tail-feather the white tip is reduced, on the fourth, third and second tail-feather two or three tawny or russet bands are present, only the central pair is without these bands.

Female Characters.—Sexual dimorphism only slight; bars on underside and pattern on tail usually less distinct in females. Apparently no difference in the coloration of hind neck and back.

		Wing	Tail	Bill	Culmen
New Caledonia[1]	1 ♂	99	73	11	18.5
	1 ♀	97		11.5	18.8
New Hebrides[2]	9 ♂	96-101(97.9)	66-72(69.2)	11.5-13(12.2)	19-20(19.7)
	1 ♀	100	70	13	21
Banks Islands[2]	4 ♂	96-100(97.5)	66-70(68.4)	12-12.5(12.2)	19.5-20.5(20.[illegible]
	1 ♀	96	67	11.5	19
Utupua[2]	1 ♀	95	66	12.5	20

Width of bill 5.0–6.0 (5.7), against 5.0–6.0 (5.5) in *lucidus*.

Range.—New Caledonia, Loyalty Islands (Lifu), New Hebrides (Epi, Ambrym, Malekula and Santo), Banks Islands (Gaua and Vanua Lava) and Santa Cruz Islands (Utupua).

I was not able to detect any differences among the birds from the said islands. The series from the New Hebrides agrees very well with the two New Caledonian skins which I have examined, and also with the original description by Mathews.

The distribution of this species is apparently closely linked up with that of its foster-parent, *Gerygone flavolateralis*. *G. fl. correiæ* was found

[1]From the Tring collection.
[2]Material of the Whitney South Sea Expedition; new records for this species.

by the Whitney Expedition on Mai, Epi, Lopevi, Ambrym, Malekula, Aoba, Gaua and Vanua Lava. The collecting of one specimen of this cuckoo on Utupua Island is rather a surprise. It is not known which species serves there as foster-parent.

Chalcites lucidus harterti, new subspecies

TYPE.—No. 226455, Amer. Mus. Nat. Hist.; ♂ ad.; Rennell Island; May 28, 1930; H. Hamlin, W. F. Coultas, and W. J. Eyerdam.

SUBSPECIFIC CHARACTERS.—Adult male. Similar to *layardi* by having a long and strong bill and by having the white on forehead, supercilium, lores and ear-coverts much reduced, but differs in other points; still smaller (wing of adult birds 90–95, against 95–101 in *layardi*, and 102–107 in *lucidus*); throat, under wing-coverts and whole underside narrowly barred, bars very glossy; crown, hind neck and fore back not dull purple, but coppery with some greenish reflections and very glossy; wing-feathers and tail-feathers also very glossy; pattern on tail rather different. Fifth tail-feather (outermost): white tip on inner web not touching shaft, but narrow white margin on outer web near the tip, white bars slightly washed with tawny. Fourth tail-feather with two large irregular tawny spots on inner web; part of the inner web of the third tail-feather also broadly edged with tawny; second tail-feather without any bars or spots of tawny.

ADULT FEMALE.—Very different from male. Crown dull purple, hind neck and fore back bronze with slight greenish reflections; throat and breast, especially on the sides, washed with light cinnamon; tail with very much more tawny; on the outermost tail-feather the white is almost entirely replaced by tawny, except for the tip; second to fourth tail-feathers have extended tawny spots.

	WING	TAIL	BILL	CULMEN	WEIGHT
3 ♂ ad.	90, 93, 95	62, 63, 64	12, 12, 12	19, 19, 19.5	19, 20, 20.5
2 ♀ ad.	90, 95	60, 63	12	19	19

Width of bill 5.0–5.5.

RANGE.—Rennell[1] and Bellona Islands.

I name this interesting new subspecies in honor of Dr. Ernst Hartert, who did so much to clear up the classification of the difficult Australonesian cuckoos.

The occurrence of a Bronze Cuckoo on Rennell Island is obviously due to the presence of a *Gerygone* on the same island.

The species *lucidus* is rather similar to some of the other members of the genus *Chalcites*, as frequent misidentifications prove. However, it is not certain which other species is the closest relative. Rensch[2] regards *Ch. malayanus* as a probable representative of *lucidus*, as apparently both species do not occur together in any part of their breeding range.

[1]See Mayr, 1931, Amer. Mus. Novit., No. 486, p. 14.
[2]1931, Mitt. Zool. Mus. Berlin, XVII, p. 544.

Considering the pattern on the tail, *Ch. ruficollis* from the mountains of New Guinea also seems to have some claim to be regarded as a representative of *lucidus*. A study of voice and habits of the three species may help in the final decision.

Bibliographical Note

To avoid a possible misunderstanding, it may be well to state that in Amer. Mus. Novit., No. 488, the second part (pp. 7–11), on the relationships and origin of the birds of Rennell Island, was written by Ernst Mayr.

AMERICAN MUSEUM NOVITATES

Published by
Number 521 THE AMERICAN MUSEUM OF NATURAL HISTORY April 11, 1932
New York City

59 57, 72 D (7)

NEW SPECIES OF DOLICHOPIDÆ FROM NORTH AMERICA AND CUBA, WITH NOTES ON KNOWN SPECIES

BY M. C. VAN DUZEE

While working up the undetermined Dolichopidæ in The American Museum of Natural History, I found the following species which seem to be undescribed. Five of these are from the W. M. Wheeler collection, now in the Museum; two were taken by Mrs. A. T. Slosson; and the remainder by others interested in the work of the Museum. The types, unless otherwise stated, are in The American Museum of Natural History.

I wish to thank Mr. C. H. Curran and those in charge of the insect collections in the Museum for the privilege of studying these interesting flies.

Chrysosoma plumosa, new species

Length, 5 mm.; length of wing the same.

MALE.—Face below the antennæ slightly wider than the front; lower part about half as wide as upper, violet in the middle, green on the sides and across the middle; seen from above it is wholly grayish-white pollinose. Front shining green, vertex white pollinose; palpi and proboscis yellow, former with yellow hair and black bristles. Antennæ (Fig. 1) yellow with the third segment black; longest bristle on second segment about as long as the diameter of the segment; arista apical, almost bare; beard white, not very long or abundant.

Dorsum of thorax bright shining green, posterior part and scutellum with blue reflections; scutellum with one pair of bristles; metanotum green; pleura dulled with white pollen; posterior edge and some of the incisures yellow. Abdomen shining green with first and base of second segment yellow, the following incisures narrowly yellow; first segment with a rather long, yellow bristle on each side; last segment with two black bristles; venter and hairs on abdomen yellow. Hypopygium (Fig. 2) black with some green color above and yellowish pollen on upper half, its lamellæ yellow, straight, rather narrow, fringed with pale hairs which are rather long at tip; there are some delicate yellow hairs on lower half of hypopygium.

All coxæ, femora, and tibiæ wholly pale yellow, with yellow hair and bristles, except a small black bristle at tip of hind tibiæ and one near tip of front femora; hind coxæ without bristles or hairs on outer surface; tibiæ without bristles, except as mentioned; middle tibiæ with conspicuous hairs above and below, those above a little more delicate, longer, and more erect than those below, they are half as long as diameter of tibia and are continued along the first segment of the tarsi, and on the following segment become more dense and almost pile-like; other tarsi plain; length

of fore tibiæ as 88, middle pair as 124, posterior as 160; segments of fore tarsi as 78–30–22–12–8; of middle as 96–41–34–18–11; of posterior ones as 79–40–25–14–11. Calypters, their cilia, and the halteres pale yellow.

Wings (Fig. 3) grayish hyaline; veins and costa yellow, not darker at tip; first vein reaching about half-way to cross-vein; fourth vein from cross-vein to fork as 40, from fork to wing margin as 26; last section of fifth vein as 21, cross-vein as 52; wings, moderately long and narrow.

Described from one male, taken at Chicago, Illinois, June 17, 1899 (W. M. Wheeler collection).

This specimen comes nearest *amabilis* Parent from Georgia, but that species has rows of hooked bristles on middle tibiæ and basitarsi. Parent puts *amabilis* in the genus *Sciapus* although it has a subapical arista. This is the first species known to me from North America that could be put into the genus *Chrysosoma.*

Sciapus trisetosus, new species

Length, 4.5 mm.

Male.—Face wide, a little narrower below, green, lower part nearly opaque with gray pollen. Front broad, green with blue reflections, vertex moderately excavated and with a few pale hairs; palpi black with pale hair; proboscis yellow. Antennæ black, bristles on second segment scarcely as long as first two antennal segments; beard white, very scanty.

Dorsum of thorax and the scutellum green with blue reflections; scutellum with two bristles, its lower surface and lower edge of metanotum yellow; pleura green, with white pollen. Abdomen shining green, mostly blue or violet on posterior segments, its hairs few and short, black with a few white ones on the sides. Hypopygium (Fig. 4) black, its lamellæ yellowish brown at base, with triangular, blackish tips.

Fore coxæ wholly yellow with a few yellow hairs on anterior surface and black bristles at tip; middle and hind coxæ and the trochanters black; hind coxæ with one black bristle on outer surface; all femora and tibiæ pale yellow; front tibiæ with four pairs of bristles above and three on lower posterior edge; middle tibiæ with a row of ten bristles on basal two-thirds of lower anterior edge and three longer, slender bristles on upper basal fourth; hind tibiæ with two bristles above, one near basal, the other at apical third; femora with a few pale hairs below and little black bristles near tip; front and middle tarsi yellowish at base, brown from tip of first segment, the hind tarsi wholly black; front basitarsi with nine, middle with four little bristles below, which are about as long as diameter of segment; hind tarsi with an erect bristle below at base, which is about as long as diameter of tibia; joints of front tarsi about as 120–40–23–11–7; of middle pair as 98–32–23–11–9. Calypters yellow with black tips and yellow cilia; halteres pale yellow.

Wings grayish; costa ciliated with black, curved hairs which are about as long as fifth segment of middle tarsi and not quite erect; these reach tip of second vein beyond which they are short; third vein gently bent backward toward its tip; fork of fourth vein less than a right angle with basal part of fourth vein; fourth vein from cross-vein to fork as 61, from fork to wing margin as 23, last section of fifth vein as 25 and cross-vein as 28.

Described from one male, taken at Gotha, Florida, in March, 1896.

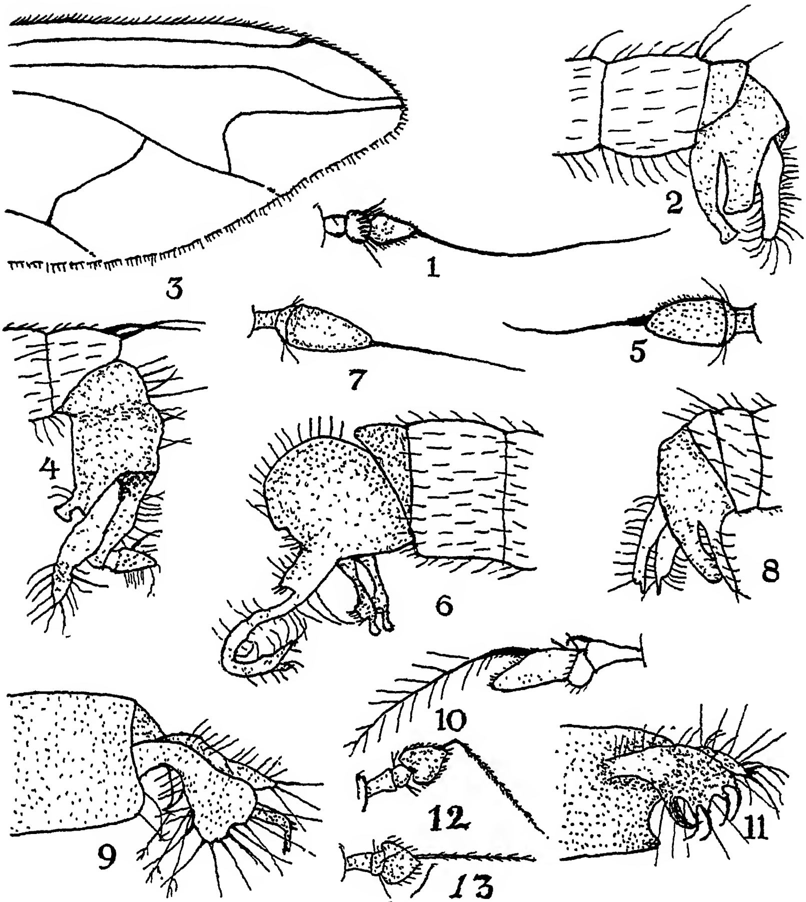


Fig. 1. *Chrysosoma plumosa*, new species. Antenna of male.
" 2. *Chrysosoma plumosa*, new species. Hypopygium of male.
" 3. *Chrysosoma plumosa*, new species. Tip of wing.
" 4. *Sciapus trisetosus*, new species. Hypopygium of male.
" 5. *Rhaphium subfurcatum*, new species. Antenna of male.
" 6. *Rhaphium subfurcatum*, new species. Hypopygium of male.
" 7. *Rhaphium wheeleri*, new species. Antenna of male.
" 8. *Rhaphium wheeleri*, new species. Hypopygium of male.
" 9. *Pelastoneurus fuscitarsis*, new species. Hypopygium of male.
" 10. *Pelastoneurus versicolor*, new species. Antenna of male.
" 11. *Pelastoneurus versicolor*, new species. Hypopygium of male.
" 12. *Diaphorus argentifacies*, new species. Antenna of male.
" 13. *Diaphorus communis*, new species. Antenna of male.

This specimen comes nearest *cilicostalus* Van Duzee, from Jamaica, but differs from it in having more bristles on front tibiæ, and a row of about eight small bristles on anterior surface of middle tibiæ.

Diaphorus communis, new species

Length, 3 mm.

MALE.—Face wide, with parallel sides, about twice as long as wide, silvery white; palpi thickly covered with white pollen and with several small black hairs. Antennæ (Fig. 13) black; third segment moderately large, triangular; arista inserted considerably above the tip, its pubescence short. Front shining green with a little white pollen just above the antennæ, as wide as the face; lower orbital cilia white.

Dorsum of thorax and abdomen shining green with bronze reflections; hairs on dorsum of abdomen short, black, on venter and sides near base long and white; four moderately large bristles at tip of abdomen. Hypopygium small with small, black appendages, central organ long, reaching beyond the hypopygium.

Coxæ and femora green; front coxæ with moderately long, white hair; middle coxæ with black hair; all coxæ with extreme tips and the trochanters yellowish; femora narrowly yellow at tip; front femora with black hair below, which is not verv long, the hair on posterior pair longer; all tibiæ wholly pale yellow; anterior tibiæ without bristles, their hair rather short, middle pair with one bristle near the base, posterior ones with seven or more rather large bristles above, without long hair on sides or below; front and middle tarsi brownish from tip of first segment; posterior pair brown, not at all or scarcely yellowish at base; pulvilli of front tarsi enlarged, middle and hind pulvilli but little enlarged; front tarsi one and one-third times as long as their tibia, middle tarsi one-sixth longer and posterior ones one-eighth shorter than their tibia; segments of front tarsi as 28–13–9–6–5; middle pair as 34–16–10–6–5; of posterior pair as 24–17–10–7–5. Calypters and halteres pale yellow, cilia of former white.

Wings a little grayish; third and fourth veins nearly straight and parallel, the fourth ending in the apex of the wing; last section of fifth vein twice as long as the cross-vein.

Described from one male, taken by R. C. Bird, June 12, 1929, in Love Co., Oklahoma.

In the group of species to which this specimen belongs, the form of the antennæ comes nearest *brevinervis* Van Duzee, but the first vein in that species is much shorter and the legs wholly black, the third antennal segment is also much smaller, and the arista is nearly apical; *communis* has the third antennal segment large and the arista inserted considerably above the point; *communis* differs from *usitatus* Van Duzee in having the third antennal segment large. In *usitatus* the third antennal segment is very small with the arista nearly apical, there are also a few white hairs on the middle coxæ and the hind tibiæ are a little brown at tip and their bristles small.

Diaphorus argentifacies, new species

Length, 2.5 mm.

MALE.—Face wide, a little longer than wide, silvery white; palpi small, covered with silvery-white pollen. Front shining blue, the white pollen of the face extending up along the orbits to the middle of the front. Antennæ (Fig. 12) black, third segment about as long as wide, somewhat triangular, arista inserted above the tip; occiput blue-green, quite shining.

Thorax and abdomen shining blue-green, dorsum of thorax mostly blue; hairs on abdomen black. those on the sides and the venter white, the white hairs extending a little on to the dorsum at base of abdomen; bristles at tip of abdomen small but distinct. Hypopygium small, with very small black lamellæ.

Front coxæ green with yellow tips and silvery-white hairs; middle and hind coxæ black; all femora shining blue-green with very narrow yellow tips, posterior pair very slightly brownish at tip; tarsi more or less brownish; joints of front tarsi as 28–13–5–4–5; of posterior pair as 20–19–9–6–5; pulvilli of all tarsi about three-fifths as long as last segment. Calypters, their cilia, and knobs of halteres white.

Wings nearly hyaline, veins blackish; third and fourth veins parallel, slightly arched, fourth ending in apex of wing; last section of fifth vein as 31, cross-vein as 12.

Described from two males, taken by E. L. Bell, June 14, 1930, at Fallon, Nevada.

This would run to Couplet 21 in the table of species in the Bulletin of the Buffalo Society of Natural Sciences, XI, page 164. Both species in that couplet (*rauterbergi* Wheeler and *albiciliata* Van Duzee) have the pollen of the face yellowish or yellowish brown, whereas in *argentifacies* it is silvery white.

Diaphorus slossonæ, new species

Length, 3 mm.

MALE.—Face rather narrow, white pollinose. Front in the middle one-third as wide as the face, wider above and below, white pollinose; palpi and proboscis yellow. Antennæ small, yellow, third segment a little rounded at apex, with a small notch where the apical arista is inserted; lateral and inferior orbital cilia white.

Dorsum of thorax green with considerable white pollen; scutellum blue. Abdomen green with yellow hair; venter yellow; bristles at tip of abdomen rather small. Hypopygium reddish, with small black appendages.

All coxæ, femora, and tibiæ wholly yellow; tarsi yellow with one or two of the apical segments black; coxæ with yellow hairs; femora with their hair partly yellow, especially on lower half; tarsi plain; pulvilli of front tarsi a little enlarged. but not much longer than the claws; front tibiæ about as 57, segments of front tarsi as 30–14–8–7–8. Calypters, their cilia and the halteres yellow.

Wings nearly hyaline with thin yellow veins, costa also yellow; third and fourth veins parallel beyond the cross-vein and with the apex of the wing between their tips; last section of fifth vein twice as long as the cross-vein.

Described from one male, taken by Mrs. A. T. Slosson, at Lake Worth, Florida.

This species is related to *ventralis* Van Duzee, *variabilis* Van Duzee, and *vulsus* Van Duzee; it differs from all of these in having the antennæ

yellow, those mentioned having the antennæ wholly black or blackish brown; *ventralis* and *vulsus* have the yellow of the venter extending on to the sides or over the dorsum of the abdomen. *D. subsejunctus* Loew, which also might be considered here, has the front linear and the antennæ black.

Diaphorus latifacies, new species

Length, 2 mm.

MALE.—Face wide, but little longer than wide, black, covered with gray pollen, making it appear dark gray Front very narrow in the middle, where the eyes almost touch, the triangles above and below large, colored like the face; palpi brown, almost reddish brown, with black hair. Antennæ black, third segment small, rounded, not quite as long as wide, apex a little flattened; arista apical, a little longer than first segment of front tarsi; orbital cilia wholly black.

Dorsum of thorax opaque with light-brown pollen. Pleura and abdomen black; tip of abdomen with four large bristles. Hypopygium small, with very small black appendages.

Coxæ and femora black, tips of femora very narrowly yellow; front coxæ with black hair; front femora with rather long black hair on the sides, and long, bristly black hairs below, middle and hind femora with shorter black hair below; tibiæ and tarsi yellow, tarsi brownish toward their tips; anterior tibiæ with a row of hairs above, which are about as long as their diameter; middle tibiæ with one small bristle near the base; hind tibiæ with one large bristle at the middle above, and another near the apical fourth, their hair moderately long; anterior tarsi one and one-eighth times longer than their tibia; middle and hind tarsi a very little shorter than their tibiæ; segments of front tarsi as 20–8–7–5–5; of middle tarsi as 16–14–9–6–5; of posterior pair as 16–13–8–6–5: pulvilli a little enlarged. Calypters brown with black cilia; knobs of halteres yellow.

Wings gray; third and fourth veins parallel beyond the cross-vein, a little arched, the apex of the wing lying between their tips; first vein reaching about half-way to tip of second vein; last section of fifth vein as 29, cross-vein as 12 and placed before the middle of the wing; wing widest near the anal angle.

Described from two males, taken by R. D. Bird, July 4, 1930, in Woods Co., Oklahoma.

This species is somewhat like *contiguus* Aldrich from the West Indies. It differs in that *contiguus* has the eyes broadly contiguous, the calypters yellow, and the front tarsi one and one-half times as long as their tibiæ; in *latifacies* the eyes are distinctly separated, even in the middle of the front, and the front tarsi are only one and one-eighth times as long as their tibiæ.

Diaphorus versicolor, new species

Length, 3.7 mm.

MALE.—Eyes contiguous on whole length of the front; face moderately wide, nearly twice as long as wide, grayish-white pollinose, with a few slender white hairs near the orbits; palpi and proboscis black, the former with black, the latter with

white hairs. Antennæ black and short; third segment twice as wide as long; apical edge rounded with a small notch where the arista is inserted, its hair long, arista long and pubescent. Occiput black with gray pollen; lower orbital cilia and the rather long beard white.

Dorsum of thorax green with coppery reflections on anterior half; scutellum blue; front of thorax a little dulled with yellowish-gray pollen; pleura green with gray pollen. Abdomen green; second, fourth and fifth segments with coppery reflections; sixth segment blue-green with four stout bristles, which are fully as long as the segment. Hypopygium with two more stout bristles which are a little shorter; venter yellowish at base; hair on upper part of dorsum of abdomen black; on the sides are a few slender, pale hairs and on the venter long white hair. Hypopygium small, mostly concealed, brown, with very small, black, outer appendages.

Coxæ and femora brown; anterior coxæ with brownish black hair, anterior trochanters and their hairs yellow; middle and hind trochanters brown; femora with white hair and some black bristle-like hairs at base or tip; all tibiæ wholly pale yellow, their hair black; front tibiæ with rows of longer hairs above and below; middle tibiæ with one bristle near base; hind tibiæ with a row of about six bristles above and a row of stiff hairs, some of which are nearly as long as the bristles, they also have long hairs below, which are a little more slender, but nearly as long as those above; tarsi yellow, becoming brown toward the tip; pulvilli yellow, the front and middle ones moderately enlarged; anterior tibiæ as 76, segments of their tarsi as 48–18–12–9–8; the tarsi being about one and one-fourth times as long as tibia, joints of middle tarsi as 53–25–18–7–7, middle tibia as 92; hind tibiæ as 110, the segments of their tarsi as 35–27–18–9–7. Calypters, their cilia, and the halteres yellow.

Wings grayish, costa brown, veins yellowish brown; third and fourth veins nearly straight and parallel beyond the cross-vein, the fourth ending in apex of wing; last section of fifth vein straight, twice as long as cross-vein.

Described from one male taken at Galveston, Texas, in June, 1900 (W. M. Wheeler collection).

This is very much like *tenuipes* Parent, from Panama, but in that species the anterior tarsi are one and one-half times as long as tibia, hind tibiæ with two bristles, brown at tip on apical fifth, the middle pulvilli not enlarged.

Diaphorus texanus, new species

Length, 2 mm.

MALE.—Face as wide as width of one eye, silvery white. Front slightly narrower than the face, white pollinose, but the green ground color showing through; palpi moderately large, about the size of one antenna, yellow, covered with silvery-white pollen. Antennæ wholly black, third segment somewhat triangular, scarcely as long as wide; lower orbital cilia whitish.

Thorax and abdomen green, somewhat dulled with gray pollen. Hairs of abdomen largely yellow, bristles of thorax black; bristles at tip of abdomen short. Hypopygium brown, mostly concealed, its hairs and very small appendages yellow.

Coxæ and femora green; tips of coxæ, trochanters, bases and tips of femora, all tibiæ and tarsi yellow, last segment of tarsi brown; anterior coxæ with a few yellow

hairs; middle tibiæ with one large bristle at basal third; hind tibiæ with one very small bristle near base; pulvilli of front and middle tarsi a very little enlarged; hind tarsi with a row of erect hairs above, which are scarcely as long as width of segments; length of front tibiæ as 42, middle as 50, and of hind ones as 59; segments of front tarsi as 28–11–7–5–5; of middle pair as 22–11–8–5–5; posterior pair as 17–14–9–6–5. Calypters brown with brownish cilia; knobs of halteres yellow.

Wings nearly hyaline, veins yellowish, costa brown; last section of fourth vein straight and parallel with third, ending in apex of wing; last section of fifth vein as 25, cross-vein as 10.

Described from one male, taken at Galveston, Texas, in June, 1900 (W. M. Wheeler collection).

This species is distinguished by its wide, silvery-white face, yellow palpi, rather dull color, green femora, and pale yellow tibiæ and tarsi.

More nearly related to *inornatus* Van Duzee than to any other North American species, but differs in having the palpi wholly yellow and all tarsi almost wholly yellow. *D. inornatus* has the palpi blackened at base, tips of hind tibiæ, their tarsi and front and middle tarsi from tip of first segment, blackish.

Rhaphium subfurcatum, new species

Length, 3 5 mm.

MALE.—Eyes contiguous, leaving a very small triangle below; palpi and proboscis black, with black hairs. Front dark shining green. Antennæ (Fig. 5) black, third segment nearly twice as long as wide, arista nearly bare, not quite twice as long as antenna; beard very sparse (I can see only a few yellowish hairs).

Thorax and scutellum dark green with slight bronze reflections; pleura more black below with a little white pollen, without hair. Abdomen green with coppery reflections; hairs above black, those on the sides brown or yellowish, short; venter black with moderately long pale hairs. Hypopygium (Fig. 6) black, outer lamellæ brown, filiform, with a few slender hairs; at the base there is a wider portion with a slight projection at tip; inner appendages are a pair of straight, yellowish brown, smooth organs with an enlargement near tip, posteriorly, which bears a few minute hairs on apical edge, beyond this is a slightly clavate, white tip.

All coxæ black, bare or nearly so; all femora and hind tibiæ and tarsi black; femora with short white hair, anterior pair with a little longer white hair below; anterior and middle tibiæ and basitarsi yellow, front and middle tarsi black from tip of first segment; hind tibiæ a little enlarged at tip; first segment of front tarsi slightly bent and with a row of very small spines below; segments of front tarsi as 30–21–10–4–3; middle pair as 39–19–12–7–5; first three segments of hind tarsi as 28–25–19. Calypters and halteres yellow, cilia of former white.

Wings in type crumpled, grayish, venation about as usual in the genus.

Described from one male, taken in Carbon County, Wyoming (W. M. Wheeler collection).

This species is easily recognized by the genital characters, the hypopygial appendages being quite distinctive, and there, together with the

wholly black coxæ, femora, and hind tibiæ and tarsi, separate it from all related forms. It would come near *nudum* Van Duzee, from Alaska.

Rhaphium wheeleri, new species

Length, about 3 mm.

MALE.—Eyes contiguous, leaving a small, white pollinose triangle below; palpi small, silvery white pollinose and with silvery white hairs; front blue-green. Antennæ (Fig. 7) black, third segment somewhat triangular, a little more than twice as long as wide, arista apical, one and one-half times as long as third antennal segment, nearly bare; lower orbital cilia white, beard silvery white.

Thorax, scutellum and abdomen shining, dark blue-green; pleura a little dulled with white pollen. Hypopygium (Fig. 8) black, outer lamellæ wide, yellowish brown, fringed with hairs; inner appendages as long as the lamellæ, partly yellow, with hairs on the edge.

Anterior coxæ yellow with long silvery white hair, without bristles; middle and hind coxæ black with white hair, the hairs at apex of middle ones long and bristle-like, but scarcely forming a thorn; all trochanters yellow; front femora broadly yellow at base and tip, blackish in the middle, posterior surface with long white hairs, which are not quite as long as width of femora; middle femora wholly yellow; hind femora yellow on basal half, black on apical half; front and middle tibiæ yellow; posterior tibiæ brown, enlarged toward the tip; hind tarsi wholly black; anterior and middle tarsi yellow, darkened from tip of first segment; segments of anterior tarsi as 23–9–5–5–7; middle pair 30–15–10–5–8; of posterior pair as 25–25–17–10–9. Calypters and halteres yellow, the former with white cilia.

Wings a little grayish; third vein bent backward a little at tip; last section of fourth vein approaches third a little, but is parallel with it at tip, their tips not very close together, fourth ending in apex of wing; last section of fifth vein as 35, cross-vein 14.

Described from one male, taken June 26, 1895, at Milwaukee, Wisconsin (W. M. Wheeler collection).

This species is separated from related forms by the contiguous eyes white hair on posterior surface of front femora, blackish hind tibiæ and the form of the hypopygial appendages. It is near *latifacies* Van Duzee, but that species has the eyes widely separated by the face.

Both species of *Raphium* described here belong to the *Porphyrops* segregate.

Thinophilus variabilis, new species

Length, about 2 mm.

MALE AND FEMALE.—Eyes touching on the middle of the face in the male, the triangle above and below opaque with brown pollen. Face in the female rather narrow, gray pollinose; palpi and proboscis black; front shining violet. Antennæ black; third segment well developed, as long as wide, rounded apically; occiput black with brown pollen; orbital cilia white.

Thorax shining black, sometimes with blue reflections, dorsum dulled with brown pollen. Abdomen shining black with a little brown pollen and slight green reflections,

its hair black; venter with white hairs. Hypopygium of male small, almost concealed under the venter.

Coxæ black, anterior pair with yellow tips and a few minute black hairs; anterior femora usually wholly or mostly yellow, sometimes more or less black above; middle and hind femora black, but sometimes wholly dark yellow; tibiæ yellow, but sometimes more or less brownish; middle and hind tibiæ each with three rather long, slender bristles above, posterior pair with two bristles on lower anterior surface; tarsi plain, more or less brown; segments of middle tarsi as 25–18–10–5–7; of posterior pair as 20–22–14–7–8. Calypters and halteres yellow, cilia of former yellowish to brown.

Wings a little tinged with brown, more so in front, veins brown; in some specimens there is no infuscation of the cross-vein, in others it is distinctly bordered with brown and there is also a brown spot near the middle of the last section of fourth vein, this spot sometimes very distinct, but usually faint or wholly wanting; last section of fourth vein straight, ending in the apex of the wing; third vein bent backward a little toward its tip, so as to approach fourth at tip; last section of fifth vein twice as long as the cross-vein; in the female the third and fourth veins are both nearly straight and parallel beyond the cross-vein.

Described from two males and six females, taken by W. J. Brown, in Quebec; Holotype, allotype and four paratypes were taken at Natashquan, August 8, 1929, and two paratypes at Thunder River, Quebec, June 11. Types in the Canadian National Collection; paratypes in American Museum of Natural History.

If the wings have spots on the veins this would run to *bimaculatus* Johnson, if not it would run to *ochrifacies* Van Duzee; it differs from both of these in having the anterior half of the wing brown, and the front shining violet.

Thinophilus brevipes, new species

Length, 4 mm.

MALE.—Face, front and occiput covered with thick grayish white pollen, the green ground color showing through a little on the vertex; the part of the face below the suture very narrow and with a short point extending down between the palpi, which are large, yellow and covered with white pollen and black hairs. First antennal segment yellow (remaining segments missing in type); orbital cilia and the short beard wholly white.

Thorax coppery, dulled with grayish-white pollen, dorsum with a median green stripe, its bristles inserted in brown dots. Abdomen green, with coppery reflections, black hair and white pollen. Hypopygium and its lamellæ black, closely folded under the abdomen, formed about as usual in the genus.

All coxæ and femora black, anterior femora more or less yellow, especially below; anterior coxæ with white hair; tibiæ yellow with moderately long, slender bristles; tarsi infuscated from tip of first segment; first three segments of front tarsi with a few very long, slender hairs; length of front tibiæ as 64, segments of front tarsi as 28–14–10–10–9; of middle as 37–15–12–11–10. Calypters and halteres dark yellow, the former with white cilia.

Wings grayish hyaline, veins yellow.

FEMALE.—Color of head, body and wings about as in the male; antennæ with third segment mostly brown; palpi larger than in male; all coxæ black, only very narrowly yellow at tip; all femora and tibiæ yellow, anterior femora darker above; front tibiæ as 64, tarsi of equal length, their segments as 26–11–10–9–9, first three segments with a few long slender hairs, but they are shorter than in the male; middle tibiæ as 84, tarsi the same, segments of middle tarsi as 43–12–11–8–10; hind tarsi as 108, tibiæ 90, segments of hind tarsi as 31–27–18–15–17; wings nearly hyaline, veins yellow; third vein bent backward toward tip, last section of fourth vein straight; apex of wing nearer tip of third vein than that of fourth vein; last section of fifth vein as 36, cross-vein as 22.

Holotype, male and allotype, female, mounted on one pin and taken by Mrs. Slosson at Biscayne Bay, Florida; one female paratype was taken at the same place.

The male is easily separated from the male of *prasinus* Johnson, by having the anterior coxæ and middle and hind femora black, with their tips scarcely yellow; the anterior femora are partly or mostly yellowish. In the species described by Johnson the anterior coxæ are yellow on apical half or two-thirds, and the femora are all wholly yellow; the females of the two species are nearly alike, but this species differs in having third and fourth veins parallel and both arched backward toward tip, and the tarsal segments somewhat different, also the front coxæ almost wholly black.

Medetera flavicosta, new species

Length, 2.2 mm.

FEMALE.—Face narrowed below, green with blue reflections; palpi brown with yellow hairs. Front mostly black with spots of blue. Antennæ wholly black, third segment about as long as wide, obtusely pointed, the arista inserted a little above the point; lower orbital cilia white.

Dorsum of thorax green with blue reflections, anterior slope mostly bright violet with a little white pollen. Abdomen shining green, its hair mostly black, a few hairs on the sides near base yellow. Ovipositor yellowish brown; scutellum with one pair of bristles.

Coxæ black with yellow tips, anterior pair with rather long, yellow hairs; femora, tibiæ and tarsi pale yellow, the posterior tarsi with last three segments a little brownish; length of front tibiæ as 40, segments of front tarsi as 20–11–8–5–7; of posterior pair as 15–26–18–8–8; second segment of hind tarsi one and two-thirds times as long as first; hair of legs and feet almost wholly black. Calypters and halteres pale yellow, cilia of former yellow, but appearing blackish in certain lights.

Wings slightly grayish, costa and veins yellow or yellowish brown, depending on the direction from which they are seen; last section of fifth vein as 20, cross-vein 13.

Described from one female, taken by Mr. C. H. Curran, July 1, 1930, at Cold Spring Harbor, Long Island, N. Y.

This species is much like *novus* Van Duzee, differing in having the antennæ wholly black, and all coxæ black with yellow tips; *novus* has first antennal segment and the front coxæ yellow.

Medetera orbiculata, new species

Length, 3 mm.

MALE.—Face black, rather wide, its sides parallel; palpi small, black. Front nearly opaque with grayish pollen. Antennæ black, third segment round with a slight notch at tip where the arista is inserted; lateral orbital cilia white, a few of the upper cilia and four bristles below black.

Thorax metallic brown with slight purple reflections, dorsum with two stripes of white pollen which extend from the front, uniting in the depressed area which is wholly white pollinose; acrostical bristles black, in two rows, but extremely small; scutellum white pollinose, with two pairs of bristles, outer pair curved and half as large as the straight middle ones. Abdomen dark greenish, covered with thin whitish pollen, its hairs small, yellowish. Hypopygium black, long, rather slender, its appendages yellowish brown, the hypopyguim and its appendages reaching nearly to the base of the venter.

Coxæ, femora, tibiæ and tarsi black, knees yellow; front coxæ with black hair; femora with short white hair below; hind tibiæ with rows of yellow hairs; segments of posterior tarsi as 18–30–16–9–6, second segment one and two-thirds times as long as first. Calypters dark yellow with white cilia; knobs of halteres pale yellow.

Wings a little grayish, costa black, veins brown; last section of fifth vein not reaching the wing margin, its length as 15 measuring to wing margin, cross-vein as 19.

Described from one male, taken at Berkeley, California, May 5, 1926.

This is like *nigripes* Loew, but the first segment of hind tarsi is much longer in proportion to second segment than in that species; it comes nearer *bicolor* Van Duzee from Alaska in that respect, which also has the legs wholly black, but that species has the third antennal segment somewhat pointed, dorsum of thorax without pollinose stripes, acrostical bristles conspicuous and last section of fifth vein nearly twice as long as cross-vein

Dolichopus tenuimanus, new species

Length, 4 mm.

MALE.—Face narrow, white pollinose, palpi yellow; proboscis yellowish brown. Front dull, dark green. Antennæ wholly yellow, first segment as long as third, third a little longer than wide, abruptly narrowed at middle of upper edge, beyond where the arista is inserted, its apex rounded; lower orbital cilia whitish.

Dorsum of thorax and scutellum purple, except lateral edges of former and center of scutellum; pleura green, with white pollen. Abdomen green, with black hair on the dorsum, lower edge of sides and the venter with a few small white hairs. Hypopygium black with green and copper reflections, its lamellæ yellowish white, somewhat oval, partly concealed in the type, but of normal size.

Coxæ yellow, middle and hind ones a little reddish brown on outer surface; front coxæ with a few minute yellow hairs and several black bristles at tip; all femora and tibiæ wholly yellow; first joint of all tarsi yellow, brown from extreme tip of first segment; anterior tarsi long and slender, not quite one and one-half times as long as tibia; all femora nearly bare below, with only a few minute yellow hairs below; front and middle femora each with one preapical bristle; anterior and posterior tibiæ

without a bristle below; anterior tibiæ with three bristles of increasing length above, their length as 84, middle tibiæ with one pair of bristles below near apical third, their basitarsi with a large bristle above near apical fourth; hind basitarsi with two large bristles above; all tarsi plain; segments of front tarsi as 54–30–21–10–6; of middle pair as 58–50–30–18–8. Calypters, their cilia, and the halteres yellow.

Wings grayish; last section of fourth vein bent near basal third; its tip in front of apex of wing; costa with a very small enlargement at tip of first vein.

Described from one male, taken in June, in the Black Mountains, North Carolina.

This specimen would run in the table of species in the Bulletin of the United States National Museum, No. 116, p. 16, F group, couplet 32, to *celeripes*, but differs from that species in having the antennæ wholly yellow, enlargement of costa smaller, middle basitarsi with a large bristle above, and in the color of the dorsum of thorax.

Pelastoneurus versicolor, new species

Length, 4 mm.

MALE.—Face narrow for the genus, as wide in the middle as the width of the third antennal segment, a little wider above and below, wholly white pollinose, concave above, a little bulging below, suture near lowest third. Front blue, seen from in front it is shining with a spot of white pollen on each side at vertex, viewed from above it is more green, dulled with gray pollen; palpi yellow with black hair. Antennæ (Fig. 10) yellow, third segment twice as long as wide, brown with yellow base; arista feathered with long hairs, first segment bare, with a curved spur at tip above; lower orbital cilia white.

Dorsum of thorax shining green, with a broad coppery stripe which includes the two rows of acrostical bristles; on posterior half there is a large violet space on each side, which is not very well defined; viewed from above there is a nearly round spot of silvery-white pollen on each side at the suture, also a silvery dot above each wing and at the lateral posterior angles; the velvety black stripe above the root of the wings distinct; scutellum green; pleura green, with white pollen. Abdomen shining green with bronze and coppery reflections; seen from the rear there is a coppery stripe up the middle of second, third, and fourth segments, but seen from above these segments have large spots of white pollen on the sides. Hypopygium black with a short peduncular segment; it is rather long and slender, its lamellæ (Fig. 11) blackish, more yellow toward the base.

Coxæ yellow, middle ones blackened on most of outer surface and hind ones to near middle; anterior coxæ with black hair and two bristles; femora and tibiæ yellow; tarsi yellow at base, becoming brown at tip; anterior and posterior tibiæ without a bristle below, middle ones with two bristles on lower anterior surface; segments of anterior tarsi as 30–14–15–12–8; middle pair as 42–25–20–11–9; first three segments of hind tarsi as 31–43–27. Calypters and halteres yellow, cilia of former black.

Wings grayish; cross-vein and bend in fourth vein very slightly infuscated; third vein very slightly bent back at tip; last section of fourth vein bent near basal third, this bend broadly rounded, beyond the bend running nearly straight, but bent backward a little at tip so as to be slightly concave posteriorly; last section of fifth vein a little arched, its length as 25, cross-vein as 15.

Described from a single male. taken by Mr. Gordon, April 12, 1926, at Soledad, Cuba.

This specimen comes nearest *acuticauda* Van Duzee, from Guatemala, but the palpi are yellow, whereas *acuticauda* has black palpi.

Pelastoneurus fuscitarsis, new species

Length, 4 mm.

MALE.—Face in the middle wider than third antennal segment, wider above and below, white pollinose, concave on upper part, a little bulging below. its suture situated near the middle. Front blue-green, dulled with brownish pollen, vertex narrowly violet; palpi black with black hair; antennæ yellow, first segment with hairs above, third about as long as wide, brown at tip, arista feathered with long hairs; orbital cilia black.

Dorsum of thorax green in front, posterior half violet, when viewed from in front it is grayish-brown pollinose and the bristles are inserted in black dots; scutellum green; pleura white pollinose; the black stripe above root of wing distinct; the silvery-white pollinose spot at the suture rather large and scarcely round. Abdomen green with wide black incisures, sides with large spots of white pollen and blue reflections, last segment wholly white pollinose. Hypopygium black with a short peduncular segment. its lamellæ (Fig. 9) black, a little yellowish at base, with a black, hooked portion extending beyond, below at base are several hairs with branched tips and two large, smooth, yellow, horn-like organs, which have minute hairs at tip.

Anterior coxæ, femora, tibiæ and the anterior tarsi yellow; front coxæ with a few black hairs and three bristles; middle coxæ black with yellow tips, hind coxæ blackened on basal half; anterior tibiæ without a bristle below; middle and hind tibiæ with one large bristle near middle of lower anterior surface; middle and hind tarsi almost wholly brown; front tibiæ about as 60, segments of anterior tarsi as 28–12–11–6–11; middle pair as 45–22–22–13–12; of hind tarsi as 29–43–32–20–16. Calypters and halteres yellow, cilia of former black.

Wings gray; third vein nearly straight; last section of fourth vein bent just before apical third; last section of fifth vein only a little curved, its length as 26, cross-vein as 16; hind margin of wing notched at tip of fifth vein; anal angle not at all prominent.

FEMALE.—Face wide, a very little brownish in the middle; front as in the male; bend in last section of fourth vein a little nearer the middle; anal angle of wing more prominent; color about as in the male.

Described from one pair, taken at Soledad, Cuba, April 9, 1926 (J.Bequaert).

Among the species with branched bristles on the hypopygial appendages this one is separated by the form of the hypopygial lamellæ.

AMERICAN MUSEUM NOVITATES

Number 522 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | April 18, 1932

59.88, 1 P (935)

BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XX[1]

NOTES ON THICKHEADS (*PACHYCEPHALA*) FROM THE SOLOMON ISLANDS

BY ERNST MAYR

There is no group of birds in the Solomon Islands with more pronounced geographic and individual variation than the thickheads. The study of these birds gains interest because of the great number of unusual and puzzling plumages found among them. The working out of all these problems has been very satisfying to me, although further work will be needed to confirm my conclusions. I have extended my revision to the thickheads occurring in eastern Melanesia and in Polynesia, and the problems presented there were in many cases the same, thus facilitating my work. The results of this study will be published in my next paper.

I am indebted to my colleagues, J. T. Zimmer and J. P. Chapin, for much valuable advice. Measurements of wing and tail were taken as described in Amer. Mus. Novit., No. 516, p. 1; the culmen is measured from the forehead; all measurements are in millimeters.

In the mountains of the islands Guadalcanar and Bougainville we find the species *Pachycephala implicata*, which was discovered by the Whitney Expedition. All the other thickheads of the Solomon Islands are representatives of *Pachycephala pectoralis.*

Pachycephala implicata

RANGE.—Mountains of Guadalcanar and Bougainville, Solomon Islands.

Pachycephala implicata implicata Hartert

Pachycephala implicata HARTERT, 1929, Amer. Mus. Novit., No. 364, p. 13, Guadalcanar Island.

TYPE.—No. 218045, Amer. Mus. Nat. Hist.; ♂ imm.; Guadalcanar Island, British Solomon Islands; July 25, 1927; R. H. Beck.

[1]Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, 469, 486, 488, 489, 502, 504, 516, and 520.

ADULT MALE.—Forehead, crown and hind neck glossy black; throat ash-gray; sides of head and ear-coverts gradually changing from black of crown to gray of throat; back, rump, scapulars, edges of wing-coverts, and secondaries (olivaceous) citrine; abdomen and flanks similar, but lighter and more yellowish; upper tail-coverts rufous olive; tail-feathers black, basal part of outer web edged with dusky olive; primaries edged with grayish or cinnamon-olive; axillaries olive, under wing-coverts olivaceous gray.

IMMATURE MALE.—As described by Hartert (*op. cit.*, p. 14) under "adult male."

ADULT FEMALE.—Forehead, crown, hind neck, and ear-coverts dark gray, tinged with olive on hind neck; back, rump, scapulars and edges of wing-coverts brownish olive (between orange-citrine and dark citrine, R. IV); throat and sides of throat white, some feathers with pale grayish tips, on lower throat pale buffy gray; breast and flanks dirty (ochre) yellow with a tinge of olive; middle of abdomen more golden yellow; under tail-coverts and lower flanks ochraceous cinnamon; edges of wing- and tail-feathers brownish.

Iris brown, bill black, feet gray.

Culmen 21, tarsus 25–26.

	WING	TAIL
1 ♂ ad.	90	69
7 ♂ imm.	85–94(89.4)	66–72(69.3)
2 ♀ ad.	88, 92	68
2 ♀ imm.	86, 86	67, 67

RANGE.—Mountains of Guadalcanar Island, British Solomon Islands.

An error occurred during the printing of the original description of this species and a part of the description was omitted, while a part of the description of *whitneyi* (*op. cit.*, p. 14, lines 14–32) was added. However, on specimen No. 218045 is written "type of *implicata*," in Hartert's own handwriting, so there can never be any doubt about the identity of this species. Hartert saw but four of the twelve specimens and not the only adult male. I have therefore given a detailed description of this specimen.

The immature male plumages are very puzzling. Several specimens still have on the hind neck apparent remnants of the nestling plumage, which is not represented in the series; it will be described under the next subspecies. The individual variation in these immature birds is very considerable: some have very soft and pointed tails, others (like the type) have a tail very much like the adult except for the coloration. The underside (breast, abdomen, flanks, and under tail-coverts) also varies considerably. In some specimens it is more greenish yellow, approaching the coloration of the adult male; in other specimens more ochraceous, like the adult female. My material is not sufficient to draw any further conclusions. This question will be dealt with again in connection with the immature plumages of *Pachycephala pectoralis*.

Pachycephala implicata richardsi, new subspecies

TYPE.—No. 226339, Amer. Mus. Nat. Hist.; ♂ ad.; Bougainville Island, Solomon Islands; January 5, 1928; F. P. Drowne, H. Hamlin, and G. Richards.

ADULT MALE.—Head, sides of head, throat, and upper breast black: back, rump, scapulars, edges of wing-coverts and wing-feathers yellowish olive; sides of throat, breast, and lower abdomen dull yellow (wax-yellow, R. XVI) with a light olive tinge; crissum, thighs, and under tail-coverts more strongly washed with brownish olive; axillaries light gray with yellowish edges, under wing-coverts gray with narrow yellowish-olive edges; inner edges of wing-feathers whitish or pale buff; outer edges of primaries olive-gray or drab; tail-feathers black, narrowly edged with olive.

ADULT FEMALE.—Similar to male, except in the coloration of head and throat; feathers of crown dark ash-gray, with darker centers and lighter edges; on nape slightly washed with olive; lores and ear-coverts chætura-drab (R. XLVI); chin, cheeks, and upper throat whitish, some feathers with blackish shafts; lower throat and upper breast pale buffy gray (drab-gray).

IMMATURE MALE (first-year plumage).—Similar to adult female, but generally lighter.

JUVENAL (nestling).—All feathers very loose and fluffy; crown dark olive, ear-coverts duller; back rufous brown, somewhat mixed with olive; cinnamon nuchal collar indicated; chin whitish; throat mixed rufous, olive and grayish; rest of underside tawny; edges of wing- and tail-feathers olive-green.

Iris, brown, bill black, feet grayish brown.

Culmen 19–20, tarsus 24–25.

	WING	TAIL
15 ♂ ad.	91–95(93.2)	65–72(68.1)
4 ♂ imm.	87–90(88 5)	65–69(66.2)
14 ♀	86–91[1](89 1)	64–68(66.3)

RANGE.—Mountains of Bougainville Island, Solomon Islands.

This interesting new form is named in honor of Mr. Guy Richards, who was a member of the party that so successfully explored the mountains of Bougainville Island.

This subspecies is at first glance very different from *implicata*, so that it might be regarded as a separate species by some other taxonomist. A closer examination of the two forms shows, however, that they are both representatives of one species.

Pachycephala pectoralis

RANGE.—From New Guinea westward to eastern Java,[2] Kalao tuah, Peling Island, and northern Moluccas, southward to Australia, Tasmania, and New Caledonia, eastward to Central Polynesia, and northward to the Solomon Islands, St. Matthias Island, and Admiralty Islands.

---

[1]Once 94.

[2]The subspecies that live in the western part of the range have been listed by Rensch, 1931, Mitt. Zool. Mus. Berlin, XVII, p. 583.

Within this wide range the species has developed about seventy geographic forms and easily surpasses by this figure any other species of bird. The arrangement of so many representatives meets with various difficulties and cannot be accomplished satisfactorily. No two ornithologists would probably come to the same conclusions, working on this difficult group.

Although all these forms represent each other, they have been separated by earlier authors into about fifteen species, and apparently with good reason. We can distinguish certain groups of closely related forms, and other forms that stand more apart. However, there is much evidence to support the viewpoint that I present in this paper. These forms are not as distinct as they may appear, but they can all be regarded as subspecies of one species.

I advocated in earlier papers (Amer. Mus. Novit., Nos. 469 and 502) the use of superspecies to unite, into one group, representatives that are too different in their characters to be regarded as subspecies. The differences between some of the subspecies listed in the following discussions are just as striking, and I attempted, at first, to recognize one superspecies with several species. I abandoned this plan, however, as I did not succeed in outlining distinct species. All the forms are somehow connected with others, and any arrangement that regards some as species and some as subspecies would be artificial.

Some of the characters to which specific value has been attributed in the past are not as important as they seem. For example, Hartert, when he described *melanonota* regarded the black back as a specific character opposed to the olive back of *orioloides*. However, we find forms with a black back at several other places in the range of *P. pectoralis*, as for example in the Santa Cruz group and the Lau Archipelago (Fiji).

The adult males of *Pachycephala p. christophori* from San Cristobal (Solomon Islands) have sometimes a black, sometimes an olive crown.

The male of *P. p. sanfordi* from Malaita (Solomon Islands) has a very distinct appearance because of the lack of the black breast-band, but the female is rather similar to that of *cinnamomea*. The male of *cinnamomea* is practically indistinguishable from that of *orioloides*, but the females of the two forms differ more from each other than the females of *cinnamomea* and *sanfordi*. We have here the interesting case in which the wide gap between the male plumages of two forms is overbridged by the female plumage. The importance of the black breast-band is doubtful, anyhow, as in other species of birds we find it also much in-

fluenced by geographical variation.[1] Furthermore, we find in the Fiji group certain islands with intermediates, which will be discussed in my next paper.

The character of "hen-feathering in males" that I found in *feminina* from Rennell Island is less important than it appears at first sight. *Pachycephala pectoralis xanthoprocta* from Norfolk Island has also hen-feathered males. The tendency to have subspecies with hen-feathered males seems to exist in several genera, for example in *Cyornis*. I do not think that this character is sufficient to establish *feminina* as a distinct species, especially since *feminina* (♂ and ♀) is very similar to the females of *centralis*.

In cases of island-birds that differ greatly from each other, the argument is often brought forward that they would not hybridize should they come together somewhere. In the species *Pachycephala pectoralis* we have, however, two instances where two widely different forms meet on one island, and freely hybridize. *Pachycephala pectoralis whitneyi* Hartert is nothing but a hybrid population, and several of the Fiji subspecies are also hybrid populations. The evidence for this will be discussed in connection with these forms. Central Polynesia and the Solomon Islands were originally inhabited by yellow-throated thick-heads. However, by later immigration from the west, white-throated birds reached these regions and hybridized freely with the yellow-throated species on small islands where their influence would not entirely disappear in a large population of original inhabitants.

In *Pachycephala pectoralis* we find very commonly the phenomenon to which Hellmayr[2] recently drew attention: "In certain genera [of Formicariidæ] the females of nearly allied forms present well-marked characters, whereas the males are not or barely distinguishable from one another. Variation of this kind, for which I now propose the technical term heterogynism, is as a rule geographical. . . ." In the Solomon Islands as well as in the New Hebrides and Santa Cruz Islands live groups of closely allied subspecies that can not, or at least not as well, be defined in the males as in the females. If, under the term heterogynism, we include all the cases where taxonomic characters are more strongly pronounced in females than in males, we find that this phenomenon is not at all rare in birds.

The forms united by me as subspecies of *pectoralis* have rather unequal value, but I believe that the uniting of all these representatives

---

[1]See Chapman, 1923, 'Mutation Among Birds in the Genus *Buarremon*.' Bull. Amer. Mus. Nat Hist., XLVIII, pp. 243–278.

[2]Journ. f. Ornith., 1929, II, p. 41.

into one species is the most logical solution. I do not claim that it is the only one, and I am willing to accept any solution that is really an improvement of the classification proposed here.

The eleven subspecies from the Solomon Islands recognized by me belong to three groups:

I.—Edges of wing-feathers of females olive; males without distinct nuchal collar, but throat yellow; crown and tail not deep glossy black; small. *christophori.*

II.—Very variable (hybrids); edges of wing-feathers of females olivaceous; males with distinct nuchal collar; throat yellow or white; crown and tail deep glossy black, small or large . . . . . *whitneyi.*

III.—Edges of wing-feathers of females russet . . . . . 1.

1.—Sexual dimorphism not present . . . . . *feminina.*
Sexual dimorphism present . . . . . 2.

2.—Black breast-band in males not present . . . . . *sanfordi.*
Black breast-band in males present . . . . . 3.

3.—Back of males black . . . . . *melanonota.*
Back of males olive . . . . . 4.

4.—Length of wing in males below 100 mm. . . . . *centralis.*
Length of wing in males above 100 mm. . . . . 5.

5.—Secondaries broadly edged with olive.
bougainvillei, *orioloides*, *pavuvu*, and *cinnamomea.*
Secondaries black . . . . . *melanoptera.*

Pachycephala pectoralis has been found in all parts of the Solomon Islands except on some smaller islands, as Ramos and Mono. It is found in the lowlands and on the mountains, but on some islands it is rather scarce in the lowlands, as on Bougainville and Malaita. In eight days of collecting at Buin, south Bougainville, we did not encounter this species. In western Choiseul, however, on the other side of Bougainville Strait, it was extremely common.

As I mentioned above, the form *whitneyi* is a hybrid between a white-throated and a yellow-throated *Pachycephala*. The white-throated form that is closest to *whitneyi*, geographically as well as in appearance, seems to be *Pachycephala pectoralis dahli* Reichenow. This subspecies was originally described from the Credner Islands, off the north coast of New Britain, but, according to Hartert,[1] it is also the form that occurs on Nissan. Considering the extreme localization in the subspecies of this bird, I am somewhat doubtful if the birds from Credner and Nissan Islands are really identical. Having no series from Credner Island, I content myself with describing my Nissan specimens.

---

[1]1926, Nov. Zool., XXXIII, p. 46.

Pachycephala pectoralis cf. **dahli** Reichenow

Pachycephala melanura dahli REICHENOW, 1897, Orn. Monatsb., V, p. 178, Credner Island, Bismarck Archipelago.

ADULT MALE (8 specimens).—Head and breast-band black; chin and throat white; rest of underside lemon-chrome; yellow nuchal collar narrow, but well developed; back light, yellowish olive, somewhat more olivaceous than sulphine yellow (R. IV); upper tail-coverts black with broad buffy-citrine edges; tail black, all feathers with narrow, pale olive tips, outermost tail-feather with a narrow pale olive edge; axillaries and under wing-coverts white with a pale yellowish tinge on the tips; wing-feathers black. inner edges whitish or pale cinnamon; outer edges of primaries pale gray near the base, pale cinnamon-gray nearer the tip; edges of secondaries pale olive-gray; lesser and median wing-coverts edged with the color of the back, greater wing-coverts edged with grayish olive; alula and primary-coverts black.

There is some individual variation: the yellow underneath is sometimes more lemon, sometimes more chrome; the upperside sometimes more olivaceous, sometimes more yellowish, and the cinnamon tinge on the gray edges of the primaries is sometimes more or less developed, but none of my eight specimens has any olive tones on the primaries.

ADULT FEMALE (3 specimens).—Crown ash-gray with a slight olive tinge and dusky shaft-streaks; chin and upper throat white with narrow grayish shaft-streaks and tips; lower throat buffy with broad grayish shaft-streaks; rest of underside breast, abdomen, and under tail-coverts lemon-chrome; sides of head hair-brown; upper back citrine-drab (R. XL), lower back brighter, more yellowish olive; upper tail-coverts brownish olive; basal part of tail-feathers brownish olive, lower part black with narrow, pale tips; wing-coverts and wing-feathers brownish black; wing-coverts edged with grayish olive; alula and primary-coverts with ash-gray edges; primaries with pale cinnamon, near the base pale cinnamon-gray edges; secondaries with pale cinnamon and olive edges; axillaries and under wing-coverts white with pale gray centers, and sometimes pale yellow tips.

FEMALE IMMATURE (1 specimen).—Similar to adult female, but less pigmented; bill brown, not black; belly pale yellow, with a buffy tinge; back dull olive-gray, tail brownish black.

Iris brown, bill black, feet grayish.

Culmen 19–21, tarsus 23–24.

	WING	TAIL	WEIGHT
8 ♂ ad.	89–94(91.5)	65–68(65.9)	27–32(29.1)
3 ♀ ad.	88, 88, 89	64, 64, 64,	27, 28, 29
1 ♀ imm.	86	61	26

RANGE.—Credner Island, Palikuru, and (fide Hartert) also Nissan.

The twelve specimens discussed above were collected by Hamlin and Mayr on Nissan Island in August 1929.

Pachycephala pectoralis whitneyi Hartert

Pachycephala pectoralis whitneyi HARTERT, 1929, Amer. Mus. Novit., No. 364, p. 14, Whitney Island, west of Shortland Island, British Solomon Islands.

ADULT MALES.—Differ from the males of *dahli* (Nissan series) in the following points: the white throat has often an admixture of yellow, the yellow of the under

side is on the average richer, more orange, the black breast-band wider, the back darker olive, the edges of the secondaries (and primaries) are much more olive, and the inner edges of the wing-feathers pure white not buffy white. *Pachycephala pectoralis whitneyi* differs from *bougainvillei* in the following points: chin always whitish, not black; throat in most specimens mixed with whitish, edges of outer primaries more grayish, smaller of size, citrine edges of upper tail-coverts broader.

On account of the high variability of this "subspecies," it is necessary to describe all the nine adult males in the collection.

WHITNEY ISLAND (December 8 and 9, 1927).

No. 219997.—Throat white, a few yellowish feathers, abdomen pale lemon-yellow; edges of primaries grayish, upper tail-coverts black with broad olive edges.

No. 219998.—Throat pure white; abdomen golden yellow; basal edge of primaries partly mixed with olive; upper tail-coverts black with narrow citrine edges.

No. 219999 (type).—Throat (except for the white chin) yellowish; abdomen rich lemon-chrome; edges of inner primaries and basal part of edges of outer primaries olivaceous; upper tail-coverts with broad olive edges.

No. 222784.—Throat white, with three or four pale yellow feathers; abdomen lemon-yellow; edges of primaries strongly mixed with yellow.

MOMALUFU (December 10, 1927).

No. 219970.—Throat yellow, slightly paler than abdomen, chin whitish with a few blackish feathers; upper tail-coverts with narrow brownish-olive edges; lower part of outermost five primaries pale gray, upper part with olive.

No. 219971.—Throat pale lemon, distinctly paler than abdomen, white bases of feathers visible; chin whitish, upper tail-coverts with broad brownish-olive edges; lower part of some of the outermost primaries pale cinnamon-gray.

No. 222786 (molting from immature into adult plumage).—Throat white with yellowish tips on just a few feathers; some feathers on the middle of the throat with grayish tips; otherwise like No. 219971.

AKIKI (December 10, 1927).

No. 219977.—Throat yellow, paler than abdomen; chin whitish; edges of primary-coverts and primaries much mixed with olive; otherwise like No. 219971.

No. 222785.—Throat white, with broad pale yellow tips on the sides and in lower part; primary-coverts black; edges of primaries light gray, of secondaries grayish olive.

ADULT FEMALE.—Differ from *dahli* (Nissan series) in the following points: the crown is less grayish, more brownish olive, thus less contrasting against the back; the back is duller, more brownish olive, not so greenish olive; the central tail-feathers and broad edges on the outer tail-feathers are olive, whereas in *dahli* the distal part of the tail-feathers is blackish, and the basal part brownish olive. On the underside the yellow is less rich and less extended toward the breast; the buffy or buffy vinaceous breast-band is much broader than in *dahli;* the edges of the secondaries and wing-coverts are more brownish. Differs from the females of *P. p. bougainvillei* in the following points; back and rump purer olive, less brownish; crown grayish, not brownish olive; tail mixed with blackish, not entirely olive; edges of wing-feathers not rufous brown; throat and breast are colored differently from abdomen, while in *bougainvillei* throat, breast, and abdomen are more or less of the same color.

Individual Variation

Whitney Island.

Four of the females are typical and agree more or less with the description Hartert gives (*op. cit.*, p. 15) (Nos. 220001, 220002, 220003, and 222787). Two specimens (Nos. 220000 and 220005) are very worn; the yellow of the belly is pale, and the grayish shaft-streaks of lower breast and flanks rather distinct; the buffy breast-band is bleached to a pale grayish-white; the upperside is very grayish. No. 220004 is like the four typical females, but the belly is pale yellow and rather heavily streaked.

Akiki.

No. 222788.—A single female from Akiki is rather brownish on ear-coverts, crown and wings; breast and flanks are very heavily streaked; the specimen is worn and molting.

Momalufu.

No. 219972.—A female from Momalufu agrees in the coloration of the upperside with some of the typical birds although it is very dull and brownish; however, it is very different underneath, showing almost no traces of yellow on the belly, which is buffy; under tail-coverts yellowish buff; breast grayish-buff; ear-coverts rufous; secondaries and wing-coverts rather brownish.

		Wing	Tail	Culmen
Whitney Island	4 ♂ ad.	89, 89.5, 92.5, 96	61, 65, 67	20, 20, 21
Momalufu Island	3 ♂ ad.	94, 97, 98	64, 68, 69	22, 22
Akiki Island	2 ♂ ad.	96, 103	70, 70	21, 22

It is remarkable that the birds with more yellow on the throat, that is, the birds that are more similar to *bougainvillei*, are also larger.

		Wing	Tail	Culmen
Throat white	2 ♂	89, 89.5	61	20, 20
Throat whitish	2 ♂	92.5, 94	64, 65	21, 22
Throat yellowish	3 ♂	96, 96, 98	67, 68, 70	21, 22
Throat yellow	2 ♂	97, 103	69, 70	22

The linkage of characters is, however, not complete, as the specimens Nos. 219997 and 222785, with yellow on the throat, have the edges of the primaries grayer than any of the white-throated specimens.

		Wing	Tail	Culmen
Whitney Island	7 ♀	87.5–92(89.6)	65–67(66.0)	19–20(19.4)
Momalufu Island	1 ♀	94	65	21
Akiki Island	1 ♀	96	67	

Tarsus in males 23–24; in females 22–23 mm.

Range.—Whitney Island, Momalufu, and Akiki. These three little islands, two and a half miles west of Shortland and eight and a half miles south of Bougainville, are apparently the entire range of this bird. However, it is possible that this form also occurs on other islands of

Bougainville Straits, as Hartert mentions a white-throated *Pachycephala* from Munia Island (Nov. Zool., XXXIII, p. 46).

I think in most cases it is not advisable to give a subspecific name to a hybrid population, but it may be defended in a case like that of *P. p. whitneyi*, where this population shows certain characters of its own and is isolated on an island or a group of islands.

The hybrid nature of *whitneyi* is proven by its high individual variation between both extremes, the characters of *dahli* and *bougainvillei*. The readiness with which the yellow-throated and the white-throated *Pachycephala* mix obliges us to include the *orioloides* group into the species *Pachycephala pectoralis*. The same phenomenon (hybridization of white-throated and yellow-throated *Pachycephala*) occurs also in the Fiji Islands and will be treated in my next paper.

P. orioloides group

Pachycephala pectoralis bougainvillei, new subspecies

TYPE.—No. 222852, Amer. Mus. Nat. Hist.; ♀ ad.; Bougainville Island, Solomon Islands; January 26, 1928; Drowne, Hamlin, and Richards.

ADULT MALE.—Almost perfectly like the males of *orioloides*, but in the average the lower belly more golden yellow, the back more citrine olive, and the black breast-band broader. These differences are only visible in the series.

ADULT FEMALE.—Differs from the females of *orioloides* by having almost no yellow tones on the underside, which is strongly washed with grayish; upperside also duller olive.

TYPE (adult female).—Upperside dull brownish-olive, more brownish on the crown, more olive on lower back and rump; upper tail-coverts and tail-feathers olive-citrine; scapulars washed with rufous; chin and upper throat whitish with narrow gray bars, lower cheeks with a yellowish wash; ear-coverts brownish; lower throat and breast pale (olive-) gray, feathers with yellowish edges and faint darker gray bars; flanks grayish, feathers with narrow yellowish edges; middle of lower belly yellowish; under tail-coverts yellow with gray centers; primaries, secondaries, and upper wing-coverts as in *orioloides* females, but axillaries and under wing-coverts whitish, not yellowish.

MALE IMMATURE (I. Phase; 4 specimens).—Wings brown, soft, wing-coverts very fluffy, first primary rounded; underside grayish, with pronounced shaft-streaks. In four specimens one is without any traces of yellow underneath, except for the yellowish under tail-coverts; two have yellowish cheeks and narrow yellow edges to all the feathers underneath; and one has the whole underside washed with pale lemon-yellow. The upperside varies greatly also: in one bird it is rufous brown with an olive tinge; in two birds it is olive with a rufous tinge; and in one grayish olive. The tail-feathers are narrow, soft, and strongly pointed. From the young males of *orioloides* they differ by the strong grayish wash of the underside, and by not being rich golden-yellow underneath and warm olive or rufous olive above; *bougainvillei* is, in females and young males, decidedly poorer in lipochromes.

MALE IMMATURE (II. Phase; 4 specimens).—Similar in coloration of the body plumage to the immature plumage (I. Phase), but generally with somewhat more lipochrome; thus the yellow wash of the underside is stronger and the olive of the upperside richer; wing- and tail-feathers approaching in their structure that of adult birds; the tail-feathers are broader and less pointed. The primaries pointed as in the adult bird, but still brown; in two of four specimens some of the secondaries are blackish with olive or brownish-olive edges, although undoubtedly belonging to the same generation of feathers as those with brown edges.

If the sexing done by the Whitney Expedition is correct, then there are apparently no definite differences between immature females and immature males (I. Phase), and between adult females and immature males (II. Phase), although the females have less lipochrome than most of the males. Two specimens (immature female and male) have practically no trace of yellow or olive on the underside and resemble in that respect females of *P. p. cinnamomea.* However, these two birds are much duller, darker, and less olive on the upperside than specimens of *cinnamomea.*

I described two types of plumages in immature males. One (I. Phase) is undoubtedly the normal immature plumage, but it is hard to say what the other immature plumage (II. Phase) is. The gonads are given as small or juvenal in all four birds, but the structure of wing- and tail-feathers is very much like in adult birds. Not all the birds of the two immature plumages are exactly like each other, and in a few specimens of this and the other Solomon Islands subspecies it is rather difficult to say to which phase they belong. I have no opportunity at present to go more into details, but apparently these two plumages have also to be treated in the chapter: "progressive" and "retarded" plumages.[1] Some of these birds in "immature" plumage (II. Phase) are apparently adult (retarded plumage) (see p. 13).

I was not able to find the nestling plumage of this subspecies; but admixture of brown tints does not always seem to be a sign of greater immaturity, although, on the average, younger birds have more brownish in the plumage.

The larger size of the Bougainville specimens may be due to the fact that most of them were collected in the mountains, while the Buka and Shortland birds were taken in the lowlands. During eight days of collecting in the plains of southern Bougainville (Buin), we did not meet a single *Pachycephala.*

The only adult female from Shortland Island is distinctly streaked on the underside, more than the Bougainville female and most of the

---

[1]See also Mayr, 1931, Amer. Mus. Novit., No. 504, p. 7.

immature males, and approaches in that respect *orioloides* females from Choiseul. This one is, however, more grayish and much less yellowish on the underside than Choiseul birds.

		Wing	Tail
Buka	4 ♂ ad.	98–105(101.8)	69–74(71.8)
Bougainville	15 ♂ ad.	102–108(104 0)	70–77(73.8)
Shortland	5 ♂ ad.	100–105(102.0)	67–75(71.1)
Bougainville	4 ♂ imm. (II. Phase)	96–101(99.2)	71–73(72.2)
Bougainville	4 ♂ imm. (I. Phase)	94–101(97.5)	71–74(72.6)
Bougainville	1 ♀ ad. (type)	99.5	72
Shortland	1 ♀ ad.	99	69
Shortland	1 ♀ imm.	96	73
Bougainville	1 ♀ imm.	94	68

Culmen (adult males), 22–24, tarsus 23–25.

Range.—Buka, Bougainville, and Shortland Islands, Solomon Islands

Pachycephala pectoralis orioloides Pucheran

Pachycephala orioloides Pucheran, 1853, 'Voy. Pôle Sud.,' Zool., III, p. 57, "îles Salomon (San Jorge)," based, *op. cit.*, Atlas Zool., Pl. v, fig. 3 (pie grièche loriot).

Pachycephala astrolabi Bonaparte, 1851, Consp. Gen. Av., I, p. 329 (*nomen nudum*).

Adult Male.—Head (forehead, crown, hind neck, lores, chin, and ear-coverts) and broad throat-band black; upper throat, narrow nuchal band, breast, abdomen, and under tail-coverts bright golden-yellow; back, scapulars, rump, and edges of upper tail-coverts and upper wing-coverts citrine olive; wings and tail blackish; tips of tail-feathers and narrow edge on outermost tail-feather pale olive; edges of alula, primary-coverts, and most wing-feathers olive; whole edge of the first two primaries and lower part of the edge of primaries three to six grayish; axillaries and lesser under wing-coverts yellow.

Individual variation occurs mainly in the following characters: width of yellow nuchal and black throat-bands, tinge of olive on the back, size of the black spot on the chin, and color of the edges of the primaries. The gray edges of the primaries and some of the secondaries are strongly washed with brownish in a few specimens. In one specimen the feathers of the black breast-band are broadly edged with yellow, and in another one several feathers of the crown are partly black and partly olive-brown.

Immature Males (I. Phase).—Upperside olive, duller and more brownish on crown, pure on rump; yellowish-olive nuchal collar scarcely indicated; fore-back and scapulars more or less mixed with rufous brown; ear-coverts rufous; lores and circumocular feathers yellowish buff; underside golden yellow, on the sides of the throat, on breast and flanks more or less strongly mixed with rufous brown; (in one specimen from Choiseul the feathers of the underside have grayish-olive shaft-streaks). Axillaries and under wing-coverts yellowish white to rufous olive; tail-feathers dull olive, strongly pointed with buffy tips; edges of wing-feathers and wing-coverts rufous brown, slightly mixed with olive on lesser and middle wing-coverts

and on the outermost primaries; wing-coverts very soft, first primary rounded; bill dark brown.

IMMATURE MALES (II. Phase).—Structure and consistency of plumage very much as in adult birds; almost no rufous on back and underside; a few black or blackish feathers on crown and breast; tail-feathers either brownish olive, or dull olive, or partly black partly olive; edges of wing-feathers and wing-coverts very varying, some feathers rufous brown, some olive, some mixed. Bill dark brown. In some of these birds which are molting their wing-feathers, it can be seen that this plumage is a retarded second-year plumage. I doubt, however, if all individuals need three molts to acquire the fully adult dress.

ADULT FEMALES.—Very variable. Upperside dull olive to brownish olive; underside yellow, paler on throat; breast and flanks often washed with olive; breast, flanks, and under tail-coverts in some specimens washed with rufous; feathers of underside in some of the Choiseul specimens with indistinct grayish-olive shaft-streaks; tail brownish olive; wing-feathers blackish brown; edges of wing-feathers and wing-coverts generally russet, only some of the lesser wing-coverts edged with russet and olive; the outermost primaries pale russet with a tinge of olive-cinnamon.

IMMATURE FEMALES.—Tail-feathers pointed, first primary rounded; wing-feathers loose and fluffy; otherwise no definite difference from the adult female. A few specimens are somewhat intermediate in the characters of wing and tail between immature and adult birds.

		Wing	Tail	Weight
Choiseul	21 ♂ ad.	100–106(102.9)	68–74(71.8)	46–55(49.9)
Choiseul	4 ♂ imm. (II. Phase)	101–104(101.8)	71–73(72.5)	47
Choiseul	4 ♂ imm. (I. Phase)	97–98(97.8)	72–74(73.2)	43, 48
Choiseul	13 ♀ ad.	96–102(98.6)	66–73(69.8)	42, 44, 50
Choiseul	6 ♀ imm.	91–98(95.3)	66–73(72.0)	
Ysabel	7 ♂ ad.	103–108(105.7)	71–76(74.0)	
Ysabel	6 ♀ ad.	94–104(98.9)	66–74(68.7)	
Florida	7 ♂ ad.	105–111(107.9)	72–79(76.3)	
Florida	1 ♀ ad.	101	73	

RANGE.—Choiseul, Molakobi, Ysabel, and Florida, British Solomon Islands.

This subspecies is, in the plumage of the adult male, practically indistinguishable from *P. p. bougainvillei* and *P. p. cinnamomea*. Heterogynism, however, makes a satisfactory classification possible. The characters of one adult female and two immature males prove that Florida birds belong to *orioloides*. A series of females and immature males from Choiseul does not agree entirely with a typical series from Ysabel. Choiseul birds show a tendency toward *bougainvillei* by having breast and flanks often distinctly streaked, or with an olive wash. Furthermore, Choiseul birds have less often than Ysabel birds a russet wash on back and breast.

Pachycephala pectoralis cinnamomea (Ramsay)

Pseudorectes cinnamomeum Ramsay, 1879 (June 5), Nature, p. 125, Gaudalcana [Guadalcanar], British Solomon Islands.

Adult Male.—Indistinguishable from that of *Pachycephala pectoralis orioloides.*

Adult Female.—Very different from the females of *orioloides* and *pavuvu;* underside very light, buffy, only faintly tinged with yellow; breast and flanks with pale grayish streaks and more or less washed with cinnamon or pale russet; under tail-coverts and thighs pale yellow, strongly contrasting with the whitish belly; upperside also poor on lipochromes, dull grayish-olive, in most specimens heavily washed with rufous; edges of wing-coverts and wing-feathers lighter rufous than in *orioloides*, and primaries with almost no olive tinge; axillaries (grayish) white, sometimes with pale yellow tips; feathers on bend of wing pale yellow.

Immature Males.—Three of the five immature males are (except for the usual juvenal characters of feather structure) very similar to adult females; they differ only by being somewhat more distinctly streaked underneath, and by being purer (less rufous) olive on the upperside. However, two other immature males have the underside strongly washed with pale lemon-yellow, and the upperside much richer olive, similar to that of adult females of *pavuvu.* Both specimens show all the characters of immature birds, such as pointed tail-feathers, rounded first primaries, and fluffy wing-coverts.

Immature Females (5 specimens).—Similar to adult females, but very conspicuously washed with russet on the upperside; underside whitish in two specimens, pale yellowish in three; breast (and flanks) washed with light rufous, under tail-coverts yellow.

Culmen 22, tarsus 24–26 (in adult males).

	Wing	Tail
19 ♂ ad.	102–110(105.3)	74–81(77.9)
5 ♂ imm.	99–101(100.2)	78–81(79.4)
7 ♀ ad.	97–103(100.1)	72–76(74.0)
5 ♀ imm.	94–101(97.0)	72–80(75.0)

Range.—Guadalcanar and Beagle Island, British Solomon Islands.

The female of this form was described by Ramsay, in Nature, 1879, as a species distinct from *Pachycephala orioloides*, with the words, "of a rich cinnamon colour, with whitish throat, yellow crissum and ochre-yellow under tail-coverts." In the final report on the Cockerell collection the "new species" is omitted, as the author apparently in the meantime had recognized the specimens as the females of *P. orioloides.* However, the splendid material of the Whitney Expedition shows clearly that the females from Guadalcanar are entirely different from typical *orioloides* females, and Ramsay's name must be used for the newly distinguished Guadalcanar form.

Pachycephala pectoralis pavuvu, new subspecies

TYPE.—No. 218101, Amer. Mus. Nat. Hist.; ♀ ad.; Banika Island, Pavuvu or Russel group, British Solomon Islands; Aug. 1, 1927; R. H. Beck and F. P. Drowne.

MALE ADULT.—Very similar to *orioloides*, but back on the average lighter olive; upper tail-coverts more broadly edged with olive, and tail-feathers in most specimens with yellow bases.

FEMALE ADULT.—Similar to the female of *orioloides* (Ysabel), but bill yellow, not brownish; yellow of underside paler, no specimen strongly washed with russet; olive or rufous olive of upperside much lighter; russet on edges of wing-feathers and wing-coverts also much lighter, more cinnamon, strongly washed with olive, especially on the lesser coverts and on the primaries.

The same differences (yellow bill, paler yellow underparts, a lighter upper surface, and more cinnamon-olive in the wing) distinguish the immature birds from those of *orioloides*.

	WING	TAIL
14 ♂ ad.	104–108(105 9)	69–75(71.5)
6 ♂ imm.	101–108	70–75
13 ♀ ad.	99–103(100.8)	65–70(67.9)
7 ♀ imm.	94–98	65–73

RANGE.—Banika, Pavuvu, and Moie, Pavuvu or Russel group, British Solomon Islands.

The four subspecies described above (*bougainvillei*, *orioloides*, *cinnamomea*, and *pavuvu*) form the *orioloides* group, characterized by heterogynism. The males are practically indistinguishable, while the females show well-developed subspecific characters.

In the central group of the Solomon Islands live three subspecies which are well characterized in both sexes.

Pachycephala pectoralis centralis, new subspecies

TYPE.—No. 222899, Amer. Mus. Nat. Hist.; ♀ ad.; Vangunu Island, central Solomon Islands; July 26, 1928; Hannibal Hamlin.

ADULT MALE.—Similar to the male of *orioloides*, but smaller; back more greenish, less olive; yellow nuchal collar narrower, often almost obsolete.

ADULT FEMALE.—On the underside pale yellow, similar to the females of *pavuvu*, but throat in most specimens whitish; breast and flanks washed with olive; upperside much darker than in *pavuvu* and even darker than in *orioloides;* back dark greenish-olive, head more rufous or brownish, in most specimens strongly contrasting against the back; no indication of a light nuchal band as in *pavuvu* and *orioloides;* wing similar to that of *pavuvu*, the edges of the primaries also strongly washed with olive; very variable in coloration; size small; bill yellowish brown.

Two females are somewhat abnormally colored; one (No. 226363) is rather rich yellow underneath, and has the plumage much mixed with rufous (on head, throat, back, and wings); the other (No. 222903) has very little lipochrome on the underside, which is conspicuously streaked with grayish olive; the lower belly is washed with rufous, and the wings and tail are dark rufous-brown.

IMMATURE MALE (I. Phase).—Very similar to adult female but on the average paler underneath and more distinctly streaked on breast and flanks; above a shade darker; more greenish, less rufous or brownish on the crown.

IMMATURE MALE (II. Phase).—All stages of plumage between that of a typical immature and that of an adult bird are represented. As in most cases the bill is black, wing and tail have the shape as in adults, and the gonads are indicated as large. I assume that all these birds are adults in retarded plumage.

IMMATURE FEMALE.—Similar to adult females, but lighter above and below.

Culmen 22–23, tarsus 24–25 (in adult males).

		WING	TAIL
Vangunu	12 ♂ ad.	94–99(95.9)	65–73(69.5)
Gatukai	8 ♂ ad.	96–98(96.7)	66–71(69.4)
New Georgia	15 ♂ ad.	90–98(94.6)	64–71(67.6)
Kulambangra	6 ♂ ad.	96–104(99 2)	68–74(71.5)
From the four islands	4 ♂ imm. (I. Phase)	91–94(93.0)	66, 66, 70
	18 ♀ ad.	89–96(92.3)	64–70(67.0)
	3 ♀ imm.	89, 90, 91	65, 68, 68

RANGE.—Eastern part of the central Solomon Islands (Kulambangra, New Georgia, Vangunu, and Gatukai).

Pachycephala pectoralis melanonota Hartert

Pachycephala melanonota HARTERT, 1908, Bull. Brit. Orn. Club, XXI, p. 106, Vella Lavella Island, British Solomon Islands.

ADULT MALE.—Upperside, wings, tail, sides of head, chin, and very broad breast-band black; throat, abdomen, and under tail-coverts golden yellow.

The other plumages of this subspecies are rather puzzling, as has been remarked already by Hartert (1929, Amer. Mus. Novit., No. 364, p. 15). Before I express my opinion about the probable sequence of plumages, I will give a short description of the twelve specimens of this subspecies in the Whitney Collection that are not adult males.

VELLA LAVELLA (6 specimens).

No. 222986 (sexed by Dr. Drowne as female with swelling ovary). Upperside blackish, feathers on hind neck with narrow olive-rusty edges; rump (blackish) olive, upper tail-coverts dark rusty; lores and circumocular feathers yellowish buff; ear-coverts and narrow superciliary stripe dark russet; chin and throat lemon-chrome, feathers with faint blackish shaft-streaks, which are more pronounced on cheeks and lower throat; narrow black breast-band; sides of breast blackish yellow; abdomen and under tail-coverts lemon-chrome with a few narrow shaft-streaks, scapulars, lower and middle wing-coverts, and basal edges of secondaries black; other wing-feathers dusky with dark rufous-brown edges; tail brownish olive; maxilla blackish, mandible horn-colored.

No. 222987 (sexed by R. H. Beck as female with swelling ovary). Similar to preceding, but still more blackish; black breast-band broad, ear-coverts blackish brown; bases of feathers on flanks blackish.

No. 222990 (sexed by R. H. Beck as female with small ovary). Crown, ear-coverts and hind neck russet; back dark greenish-olive, with a brownish tinge and indistinct blackish spots; upper tail-coverts cinnamon with blackish centers; tail dull olive; underside lemon-chrome; throat paler, breast-feathers with faint blackish bars, wing-feathers and wing-coverts with rufous-brown edges.

No. 222988 (sexed by R. H. Beck as female with small ovary). Similar to preceding, but whole back and underside strongly washed with rufous; yellow of the amber-brown underside visible only on the bases of the feathers and in the middle of the abdomen. Blackish marks on back and breast missing.

No. 219993 (sexed by R. H. Beck as male with small testes). Very similar to No. 222990, but back and tail more brownish; underside deeper yellow; fine blackish bars on throat and breast more distinct.

No. 222989 (sexed by Polynesian assistant as male with small testes). Similar to No. 219993, but still more washed with rufous especially on throat, breast, and flanks; feathers of wing and tail obviously immature.

Ganonga (6 specimens).

No. 222802 (sexed by R. H. Beck as female with rather large ovary). Somewhat similar to normal females from Vella Lavella, but pronounced olive-brownish breast-band; under tail-coverts rufous, rest of underside rich yellow, with faint olive staft-streaks, a slight rufous wash and olive flanks; crown rusty olive, not russet; back without blackish or russet; bill black.

No 222801 (sexed by R. H. Beck as male with large testes). Feathers of upperside either black or olive or both; wing- and tail-feathers half black, half olive-brown; underside like No. 222986; ear-coverts blackish olive-brown, not russet; bill black.

No. 219987 (sexed by F. P. Drowne as juvenal male). Crown and hind neck (rufous) olive. Superciliary, ear-coverts and sides of neck russet; back and tail dull olive; rump brighter; underside (pale) yellow, all feathers with dusky centers, more pronounced on the breast; these grayish centers make the whole underside look somewhat olivaceous; edges of wing-coverts and wing-feathers brownish, more brownish olive on lesser wing-coverts and primaries.

No. 219985, 219986 (both sexed as juv. males) and No. 219988 (sex doubtful). Very similar to No. 219987, but No. 219985 has still the remainder of the nestling plumage in form of rufous feathers on the sides of the throat, on the hind neck and on the under tail-coverts.

The female (Meek Coll.) described by Hartert (in Amer. Mus. Novit., No. 364, p. 15) seems to connect somewhat the two female plumages. We probably have to consider these females with blackish breast-band and back as melanistic specimens. Complete melanism is shown by the adult male No. 329088, in which the entire plumage is black.

In my opinion the plumages of *melanonota* that I described above, and also the plumages from the Meek Collection mentioned by E. Hartert, can be divided into the following groups.

I.—Adult males.
II.—Immature males (II. Phase): No. 222801.
III.—Immature males (I. Phase): Nos. 219993, 222983, 219985–219988.
IV.—Adult females (normal coloration): Nos. 222988, 222990, 222802.
V.—Adult females (melanistic): Nos. 222986, 222987.
VI.—Immature females.

		Wing	Tail
Vella Lavella	7 ♂ ad.	95–101(93.0)	66–72(68 2)
	4 ♀ ad.	96–98(96.5)	68, 68, 69
	2 ♂ imm.	97, 97	69, 69
Ganonga	14 ♂ ad.	95–102(98.3)	67–74(69.9)
	1 ♀ ad.	93	68
	5 ♂ imm.	88–96(92.2)	67–70(68 4)

Range.—Vella Lavella and Ganonga, western part of the central Solomon Islands.

The birds from Ganonga do not perfectly agree with typical Vella Lavella birds. Several of the adult males have olive edges on the wing-feathers, the adult female and the immature males lack the russet crown, and the four immature males have a distinct olive pattern on the underside, lacking in typical birds. My material, however, is not sufficient to justify a separation of the Ganonga birds.

Pachycephala pectoralis melanoptera, new subspecies

Type.—No. 226318, Amer. Mus. Nat. Hist.; ♂ ad.; Tetipari, central Solomon Islands; August 4, 1928; Hannibal Hamlin.

Adult Male.—Differs from *orioloides* by having the yellow nuchal collar indistinct; the back less olive, more greenish and often intermixed with blackish spots, the bill longer; and the wing of a different coloration. The wing is deep black, except the edges of the lesser upper wing-coverts, which are olive, and the edges of some of the primaries, which are grayish; in some specimens also the greater upper wing-coverts and a few of the innermost secondaries are narrowly edged with olive. Differs from *centralis* by its size and the color of the wing.

Adult Female.—On under- and upperside strongly washed with russet; in general style of coloration somewhat intermediate between female, No. 222988, of *melanonota* (see p. 17) and the females of *cinnamomea*. Bill black; crown rufous brown (argus brown, R. III); back rufous brown mixed with dull olive, especially on rump; upper tail-coverts and tail dull olive with rufous tinge; underside cinnamon-rufous mixed on abdomen with pale yellow; wing-feathers dusky edged with russet or olivaceous russet). Females from Rendova have the cinnamon-rufous of the underside more concentrated on the breast.

Immature Male.—Similar to adult female, but with less russet on back and abdomen.

Culmen 23–25, tarsus 25–26 (in adult males).

		Wing	Tail
Rendova	10 ♂ ad.	102–108(104.5)	69–77(73.7)
	4 ♀ ad.	97–101(98.8)	68–72(70.2)
Tetipari	13 ♂ ad.	104–109(106 3)	70–78(74.2)
	3 ♀ ad.	103, 103, 104	73, 75, 75

Range.—Rendova and Tetipari Islands, southern part of central Solomon Islands.

This very distinct subspecies is another proof of the endemic character of the bird-life of Rendova and Tetipari. Rendova is only two miles away from Rubiana (New Georgia group) and only five miles from the mainland of New Georgia, inhabited by *centralis*. This illustrates the sedentary character of the members of this species.

The revision of the forms of *Pachycephala pectoralis* in the Solomon Islands and in the Santa Cruz group enables me now to give a more definite statement concerning the relationship of *Pachycephala feminina*. I found, somewhat to my surprise that both sexes of *feminina* are very similar to the female of *centralis*, in fact, more similar than the females of any member of the *orioloides* group are to the females of *centralis*. There is no doubt in my mind that *feminina* has its next relative in *centralis*, and should, accordingly, in a classification, be arranged somewhere near it.

The phenomenon that *feminina* shows no sexual dimorphism does not prevent me from including it in the species *pectoralis* (see also p. 5). We know from experimental genetics that the factor of "hen-feathering in males" may be of small importance, caused by one or two genes only.

Pachycephala pectoralis feminina Mayr

Pachycephala feminina Mayr, 1931, Amer. Mus. Novit., No. 486, p. 25.

Range.—Rennell Island.

For description and measurements see Novitates No. 486.

Pachycephala pectoralis christophori Tristram

Pachycephala christophori Tristram, 1879, Ibis, p. 441, Makira Harbour, San Cristobal Island, British Solomon Islands.

Adult Male.—Crown dark citrine, blackish-olive or entirely black; ear-coverts olivaceous cinnamon to black; underside lemon-yellow except for the black breast-band; feathers in lower and lateral part of black breast-band sometimes with yellow or olive tips; yellow of lower breast sometimes mixed with brownish; sides of neck yellow or light olive, forming an interrupted nuchal band; back, scapulars, edges of wing-coverts, secondaries and inner primaries, and tail, olive; tail-feathers in some

specimens more or less black, with olive edges and tips; edges of outermost primaries grayish or drab; bill black or dark brown.

Immature Male.—Similar to adult female, but wing-coverts and secondaries edged with russet; tail pointed. One specimen still has some of the loose feathers of the nestling plumage; they are rufous brown on ear-coverts, lower belly, and under tail-coverts, and brownish olive on crown and neck. Two males (one sexed as female) have wing and tail of adult birds, but only an indication of the black breast-band; they seem to correspond to the plumage I have described as immature plumage (II. Phase) in other subspecies of *pectoralis*.

Adult Female.—Upperside olive, sides of head more brownish; underside yellowish with more or less distinct olive breast band.

Culmen 21, tarsus 24–25 (in adult males).

		Wing	Tail	Weight
San Cristobal	12 ♂ ad.	87–89(87.8)	59–61(60 2)	33, 35, 35
	7 ♀ ad.	84–90(86 1)	57–61(59 4)	33, 34
Santa Anna	6 ♂ ad.	87–90(88 5)	57–60(58 7)	34, 35, 35
	8 ♀ ad.	84–88(85.8)	55–59(56 8)	29, 32, 33

Range.—San Cristobal and Santa Anna, British Solomon Islands. From Ugi Island reported by Ramsay.

The individual variation in the coloration of the males of this species is very remarkable. In the original description the species is described as having the whole upperside olive. Meek, however, collected some specimens with the crown perfectly black (Hartert, 1929, Amer. Mus. Novit., No. 364, p. 15). In the fourteen adult males from San Cristobal that I have at hand, three have the crown citrine-olive and the ear-coverts cinnamon, two have crown and ear-coverts entirely black, while the other nine birds show all the intermediate stages of melanization. All these birds were collected in the eastern part of the north coast (Star Harbour, Wanoni Bay, and Kira-Kira).

A series of six adult males from Santa Anna Island falls within the range of individual variation of the San Cristobal birds. However, these birds form a very uniform series. They all have the rufous-brown patch on the lower breast, and have the blackish color of the head reduced to the loral region and a blackish tinge of the brownish ear-coverts. Females from Santa Anna are absolutely identical with those from San Cristobal.

This form is rather different from its representatives on the other islands of the Solomon group and usually has been regarded, therefore, as a distinct species. However, this bird does not differ from its representatives in its behavior.

Pachycephala pectoralis sanfordi Mayr

Pachycephala sanfordi Mayr, 1931, Amer. Mus. Novit., No. 504, p. 22, Malaita Island.

Range.—Malaita Island, British Solomon Islands.

For description and measurements see American Museum Novitates No. 504.

I described this bird originally as a distinct species. However, since I make subspecies of all the representatives of *pectoralis*, *sanfordi* also has to be included. The male is very distinct indeed by having no black pectoral band; yet the female is rather similar to that of *cinnamomea*. It differs mainly by having almost no rufous or russet color on the upperside, which is more or less dull greenish-olive, and by having no rufous or buffy colors on the underside, which is distinctly streaked on throat, breast, and flanks.

I did not mention anything about the immature plumages of this subspecies in the original description, as I wanted to study these plumages first in the related forms. Besides a series of adult males and females, we collected two males that have more or less of the feather structure and coloration of adult birds, but have on crown, wings, and tail a coloration intermediate between those of immature and adult. They are probably adult birds in retarded plumage.

Another bird (No. 227336) is sexed as female with small ovary, and has the plumage characters of an adult bird, but combines in its coloration the characters of male and female. The underside is yellowish, except for some female feathers on throat, breast, flanks, and under tail-coverts; the back is dull greenish-olive like that of the females, but the crown and sides of the head are mixed with blackish; tail and wings blackish with olive or rufous-olive edges. The bird is probably a cock-feathered female.

A series of immature females shows that the immature female plumage is very much like that of the adult except for the juvenal wing and tail.

This concludes the forms of *Pachycephala* known from the Solomon Islands. However, I think it necessary to say a few words about a bird named *P. salomonis* by Oustalet[1] and described as follows:

> Un autre spécimen, rapporté des îles Salomon par MM. Hombron et Jacquinot, appartient sans doute à la même espèce [*P. vanikorensis*]: il a précisément les mêmes dimensions; mais les bordures des pennes secondaires et des couvertures ont une teinte légèrement différente plus grisâtre et moins olivâtre; peut-être cependant est-ce une variété qu'on pourrait désigner sous le nom de *P. salomonis*.

[1]Oustalet, 1877, 'Sur le genre *Pachycephala*,' Bull. Soc. Philomath., Paris, (6) XI, p. 95.

The locality, Solomon Islands, assigned to this species by Oustalet is undoubtedly wrong. The 'Astrolabe' Expedition which collected the specimen never stopped at the Solomon Islands.

Mr. Berlioz has very kindly given me extensive information concerning the type of *P. salomonis* which, I hope, will somewhat facilitate the classification of this species.

Mr. Berlioz writes me that the type is a male which is rather similar to the males of *P. p. vanikorensis*, but has, as Oustalet correctly states, the edges of the wing-feathers grayish instead of olive. I have looked through the large series of *vanikorensis* in the American Museum and find very little variation in the color of the wing-feathers which always have olive edges. Furthermore, the type of *salomonis* is, according to Berlioz, deeper yellow underneath, more yellowish olive than dark olive on the back, and slightly larger. Mr. Berlioz suggests, therefore, that *P. salomonis* is perhaps identical with *P. p. dahli* Reichenow, which differs from *vanikorensis* in the same characters. A series of males of *vanikorensis* have a wing-length of 85–87 mm., while I find that *dahli* has a wing-length of 89–94 mm. The possibility that *salomonis* is the same as *dahli* is strengthened by the fact that the 'Astrolabe' Expedition collected on New Ireland. However, considering the great number of very similar subspecies of *P. pectoralis*, some of which can not be distinguished at all in the male sex, it would be hazardous to synonymize *P. p. dahli* Reichenow with *P. salomonis*, a bird without locality. *P. salomonis* will have to be put in the list of unidentifiable species.

AMERICAN MUSEUM NOVITATES

Number 523 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | April 26, 1932

59.88, 1 M (85)

STUDIES OF PERUVIAN BIRDS. III

THE GENUS *MYRMOTHERULA* IN PERU, WITH NOTES ON EXTRALIMITAL FORMS. PART 1

BY JOHN T. ZIMMER

Myrmotherula brachyura brachyura (Hermann)

Muscicapa brachyura HERMANN, 1783, 'Tab. Aff. Anim.,' p. 299, note—Cayenne.

A series of about one hundred birds from all parts of the range of this species has permitted a careful study of the characteristics of this widely spread group. In most respects there is striking uniformity throughout the entire range of the present subspecies. Females occasionally show a strong orange tint on the breast; others vary in the degree to which the throat is lighter than the breast or in the amount of streaking on the sides of the breast. In none of these respects is it possible to segregate any recognizable forms. However, in northern Perú, southeastern Ecuador, and west-Amazonian Brazil is found a bird that is sharply distinguishable from typical *brachyura*, which occurs with it at the same localities. There are seventeen specimens of this peculiar bird at hand and all of them agree in the characters which distinguish the form from *brachyura*. If it were found alone in this region it unquestionably would be considered as a conspecies of *brachyura*, but with *brachyura* occurring at the same places, there is nothing to do but treat it as a distinct species. Accordingly it is named and further discussed below.

It is impossible to say, without examining all the material previously recorded as *brachyura*, which Peruvian records belong to the new form and which to *brachyura*. Thus far the new form has been recognized only in material from the Ucayali, the Napo region, and the Amazon somewhat below the mouths of these streams. This is a recognizable faunal area in which other peculiar forms have been found segregated and it may be that all records from outside that area are of typical *brachyura*. If so there may be added to the localities in the list of specimens examined, Yahuarmayo, Xeberos, Yurimaguas, Chyavetas, and Chamicuros. A record from Pebas may be one or it may be the other.

Myrmotherula obscura, new species

Type from the mouth of the Río Curaray, eastern Ecuador. No. 255,755, American Museum of Natural History. Adult male collected October 26, 1925, by A. M. Olalla and sons.

Diagnosis.—Very similar to *M. b. brachyura* in general appearance but upper side much darker; white margins on top of head in males reduced considerably and often absent on some of the feathers; black mystacal stripe and black post-ocular area much broader; interscapulars usually without exposed white margins or these only indicated, but yellowish, concealed patch or mantle and the pale markings on scapulars and upper wing-coverts as broad as in *brachyura:* rump blacker. less grayish; pale margins of tertials reduced or obsolete; pale outermargins of primaries and outer secondaries falling short of tips of greater wing-coverts, leaving a blackish area beyond the latter. Females with pale markings on top and sides of the head darker and more rufescent, less ochraceous, than in *brachyura,* and usually also somewhat narrower; pale markings on interscapulars much narrower than in *brachyura* and whiter, less buffy; black mystacal stripe and black postocular stripe broader, more conspicuous. Both sexes with bill distinctly shorter than in *brachyura,* and wings averaging longer and tail averaging shorter.

Range.—Humid Tropical Zone of northern Perú and southeastern Ecuador, extending along the south bank of the Amazon as far east as Teffé, Brazil.

Description of Type.—Upper surface largely black; a few fine white scratches on the crown; a fine white superciliary line from the bill to the hind neck and a broad white stripe below the eye from the base of the bill to behind the auriculars, leaving an equally broad black stripe from the rictus through the lores and postocular region to the sides of the neck; below this an equally broad black mystacal stripe which is continued over the sides of the breast. Interscapular region with a large patch of pale yellow concealed by the black tips of the feathers; scapulars with a broad yellowish-white stripe along outer margins, occupying most of outer web on the uppermost feathers. Outer surface of wings largely black; lesser coverts at humero-radial angle with broad, pale yellow bases, forming a patch; pale yellowish-white tips of median and greater coverts forming two broad wing-bars; on the middle coverts the pale area crosses both webs; on the greater series it is almost confined to the outer webs; tertials with quite narrow margins (falling far short of tips) pale yellowish-white; secondaries and primaries with very narrow yellowish-white outer marginal lines falling short of the tips and separated from the bases by a wide blackish space (the pale marginal line obsolete on the outermost primary and nearly so on the penultimate). Bend of wing near base of primary-coverts pale yellow. Chin, throat, and fore part of chest white; breast, belly, sides, flanks, under wing-coverts, axillars, and basal portion of inner margins of remiges Massicot Yellow x Straw Yellow.[1] Tail black, composed of twelve rectrices, lightly rounded for 3 mm.; tip of outermost rectrices very narrowly whitish; under tail-coverts longer than the outermost rectrices. Maxilla black (in dried skin); mandible whitish, darker at tip; tarsus dull grayish. Wing, 46.5 mm.; tail, 17; exposed culmen, 11; culmen from base, 14; tarsus, 17.

Remarks.—Females with much the same pattern of coloration as the males, but pale streaks on top of head noticeably broader, deep

[1]Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

ochraceous buffy; margins on interscapulars largely confined to inner webs, and whitish; concealed patch on mantle practically obsolete; throat and breast variably light buff to deep orange-buff; rest of under parts yellow as in the male; wings and tail colored as in the male. Wings, 44–49 mm. (av. 46.88); tail, 16.5–19.5 (av., 17.58); exposed culmen, 10–11 (av., 10.64); culmen from base, 13–15 (av., 13.93); tarsus, 16–17.25.

The series of males measure: wing, 44.5–48 mm. (av., 46.03); tail, 16–18 (av., 16.25); exposed culmen, 10.25–11 (av., 10.62); culmen from base, 13.25–14 (av., 13.52); tarsus, 16–17.

In comparison with these figures, males of *brachyura* show the following measurements: wing, 41–47 mm. (av., 44.78); tail, 16–21 (av., 17.78); exposed culmen, 11–13 (av., 12.18); culmen from base, 14–16 (av., 15.19). Females: wing, 43–47 mm. (av., 44.30); tail, 16.5–20.5 (av., 18.20); exposed culmen, 11–13 (av., 11.80); culmen from base, 13.75–16 (av., 14.95). The averages are slightly different if the specimens are restricted to those from the region where *obscura* has been found. Such *brachyura* males average: wing, 45.31 mm.; tail, 17.67; exposed culmen, 12.34; culmen from base, 15.34. Females from the same area: wing, 44.55; tail, 18.53; exposed culmen, 12.27; culmen from base, 15.11. Thus where both forms occur together the difference in length of bill is intensified.

It may seem to be straining a point to describe as a distinct species a form as close to *M. brachyura* as is the one named herewith. It may even be doubted that two such species exist since *obscura* inhabits part of the range of *brachyura* but no regions outside of that range, and therefore might appear to be only a local variant of *brachyura*. Nevertheless, there are certain curious facts in connection with the new form which are hardly to be explained on the basis of local variation.

The seventeen specimens which have been segregated as *obscura* cannot be matched in the series of a hundred skins of *brachyura* from all parts of the range of that form. Not only are they uniformly more extensively black on the upper surface (other pale markings are not correspondingly affected) but this characteristic is regularly accompanied by a reduction in the length of the bill (though not so constantly in other measurements examined). The seventeen *obscura* are all from a limited region and not from all parts of the range of *brachyura*. In the series of *brachyura*, the darker specimens (all lighter than *obscura*) show no tendency toward reduction in the length of the bill, while the specimens which have the shortest bills (rarely as small as in *obscura*) are not

darker than the other *brachyura;* yet, within a limited area embracing parts of upper Amazonia, all the birds with small bills have a decided reduction in certain parts of the paler portions of the plumage. As a matter of fact, the examples of typical *brachyura* from this same region are inclined to have a greater extension of pale dorsal markings than the average from other localities.

The features are sufficiently distinctive to warrant the naming of the form possessing them. It is hoped that this detailed account will give enough prominence to the case to keep it in the purview of taxonomists and other workers until more facts are brought to light concerning it. It is entirely possible that while certain skins of *obscura* and of *brachyura* are labeled as having been collected in the same localities, the ecological associations of each series may have been entirely different. Both series contain immature specimens, so the differences cannot be due to age; and some were taken on the same day, which precludes the factor of seasonal variation. There still remains the possibility of there being a color "phase," though why this should be associated with a difference in length of bill is not clear.

Specimens Examined

M. b. brachyura.—French Guiana: Pied Saut, Oyapock, 1 ♂, 1 ♀. British Guiana: Rockstone, Essequibo River, 1 ♂; Potaro Landing, 1 ♂; Minnehaha Creek, 1 ♀. Venezuela: Foot of Mt. Duida, 1 ♂, 2 ♀; Esmeralda 1 ♂; Caño León, 2 ♂; Playa del Río Base, 3 ♀, 1 (?); El Merey, Río Cassiquiare, 1 ♂; opposite El Merey, 1 ♂, 1 ♀; Río Orinoco at mouth of Río Ocamo, 2 ♀; opposite the mouth ot Río Ocamo, 2 ♂, 3 ♀. Brazil: Yucabi, Rio Negro, 4 ♂, 3 ♀; Tahuapunto, Rio Uaupés, 2 ♂, 1 ♀; Santo Isidoro, Teffé, 1 ♀; Igarapé Auará, Rio Madeira, 1 ♂, 1 ♀; Igarapé Brabo, Rio Tapajoz, 1 ♀; Tauarý, 2 ♀; Piquiatuba, 1 ♀; Caxiricatuba, 2 ♂; Cametá, Rio Tocantins, 1 ♀; Santa Elena, Rio Jamauchim, 1 ♂; Faro, Rio Jamunda, 1 ♂, 1 ♀. Bolivia: Todos Santos, 2 ♂, 2 ♀. Colombia: La Morelia, Caquetá, 1 ♂; Florencia, 1 ♀; San José, Cauca, 1 " ♀ " (= ♂); Bogotá, 1 ♂.[1] Ecuador: Río Suno, above Avila, 1 ♂, 1 ♀; lower Río Suno, 1 ♀; mouth of Río Curaray, 2 ♂, 3 ♀; below San José, 2 ♂, 1 ♀. Perú: Puerto Indiana, Río Amazonas, 1 ♂; mouth of Río Urubamba, 1 ♂; Lagarto, upper Ucayali, 1 ♀; Santa Rosa, upper Ucayali, 13 ♂, 6 ♀; Perené, Junín, 1 ♂; Astillero, 1 ♂, 1 ♀; Río Tavara, 1 ♀; Río Negro, west of Moyobamba, 1 ♂, 1 ♀; Río Seco, west of Moyobamba, 1 ♀; Moyobamba, 2 ♀[1]; Pomará, Río Marañón, 2 ♀.

M. b. ignota.—Panamá: 1 ♂.

M. obscura.—Ecuador: mouth of Río Curaray, 3 ♂ (incl. type); Río Suno, above Avila, 2 ♂, 1 ♀; lower Río Suno, 1 ♂, 1 ♀; below San José, 1 ♀. Perú: Puerto Indiana, Río Amazonas, 1 ♀; Orosa, 1 ♀; mouth of Río Urubamba, 1 ♀; Puerto Bermúdez, 1 ♂[1]; Pomará, Río Marañón, 1 ♂, 2 ♀. Brazil: Boca Lago, Teffé, 1 ♀.

[1]Specimen in Field Museum of Natural History, Chicago.

Myrmotherula surinamensis multostriata Sclater

Myrmotherula multostriata Sclater, 1858, P. Z. S. London, XXVI, p. 234, Pl. cxli, figs. 2 (♂), 3 (♀)—r. Ucayali; ♀; British Mus.

A male and two females from Sarayacu, Río Ucayali are probably topotypical, and one other male from Lagarto, upper Ucayali, is nearly so. Two males and four females from the mouth of the Napo, north of the Amazon in Perú, and a female from the mouth of the Curaray, in eastern Ecuador, are inseparable from the Ucayali birds. A series of four males and thirteen females from various localities in Brazil south of the Amazon, from the Rio Madeira to Pará, likewise show no recognizable differences, though there is a certain amount of variation among the females throughout this extensive range, without passing outside of the characters of *multostriata*. Pebas and Nauta records undoubtedly belong with the birds from the mouth of the Napo. A single male from Santa Cruz (Río Huallaga), in the British Museum, has been assigned to this form also by Sclater and by Hellmayr, and constitutes the only record from the Huallaga system. The Huambo record by Taczanowski has been transferred by Hellmayr to the *longicauda* group and probably belongs with Gyldenstolpe's *pseudoaustralis*, though Gyldenstolpe (Ark. Zool., XXI A, (26), p. 19, 1930) has retained the locality in the range of *multostriata* without, however, re-examination of the specimen.

Specimens Examined

M. s. multostriata.—Perú: Sarayacu, 1♂, 2♀; Lagarto, upper Ucayali, 1♂; Puerto Indiana, 1♂, 4♀; Apayacu (=Anayacu), 1♂. Ecuador: mouth of the Río Curaray, 1♀. Brazil: "Camp 8," Rio Roosevelt, Matto Grosso, 1♀; Borba, 3♂; Santo Antonio de Guajará, Rio Madeira, 1♀; Igarapé Auará, Rio Madeira, 1♂, 3♀; Villa Bella Imperatríz, 2♂, 3♀; Caxiricatuba, Rio Tapajoz, 1♀; Isla Pae Lourenço, Rio Tocantins, 1♀; Pará (Una), 1♂.

M. s. surinamensis.—British Guiana: 3♂, 1♀. French Guiana: 1♂, 1♀. Venezuela: 7♂, 4♀.

M. s. pacifica.—Colombia: 16♂, 17♀. Ecuador (western): 3♂, 2♀.

Myrmotherula ambigua, new species

Type from Playa del Río Base, Mt. Duida, Venezuela, altitude 550 feet. No. 273,547, American Museum of Natural History. Adult male collected November 29, 1928, by the Olalla brothers.

Diagnosis.—Nearly allied to *M. sclateri* of the Rio Tapajoz, Brazil, but the male has the pale streaks on the top and sides of the head white instead of yellow; streaks on back paler yellow; concealed yellow patch on mantle smaller. Similar to *M. b. brachyura* but tail and bill longer and throat yellow, not white. Tail more uniform blackish, not grayish with a blackish distal area. Female like that of *sclateri* but with under parts almost unstreaked yellow except for dull markings on the sides of breast

on a buffy ground; top and sides of head streaked with ochraceous buff instead of yellow. Similar to female of *M. b. brachyura* but bill and tail longer and throat yellow instead of buff.

RANGE.—Lowlands from the foot of Mt. Duida in Venezuela to the Rio Uaupés in Brazil.

DESCRIPTION OF TYPE.—Top of head and top and sides of neck black with both lateral margins of the feathers pure white, giving a streaked appearance to the area; the white is more solid on the upper lores and over the eye to the nape, making a white superciliary stripe; below this a black line through the eye from the base of the bill through the middle lores and postocular region; auriculars, subocular region, and lower part of lores white with the shafts of the auriculars narrowly black; a prominent blackish mystacal stripe bordered above by white and below by yellow. Whole under parts between Citron Yellow and Amber Yellow with the blackish mystacal stripe continued down the sides of the breast where, however, the upper border of the stripe is yellow; outer thigh feathers black at base. Mantle streaked like the top of the head but the pale borders of the feathers are lightly tinged with yellow; a relatively small patch of Primrose Yellow x Colonial Buff concealed in the center of the mantle; rump olive grayish; upper tail-coverts grayish at base with a black area toward the tip followed by a whitish terminal border. Tail, double-rounded, graduated for 6 mm. but with the innermost rectrices just shorter than the next. Rectrices 12, black, with narrow, pale grayish external margins; inner margins of innermost pair narrowly whitish, less apparent on more exterior feathers; tips of all rectrices pale yellowish, quite narrow on innermost pair, broadest on outermost. Wings largely blackish exteriorly; bases of lesser coverts at humero-radial angle pale yellow at base, forming a noticeable patch; middle coverts with broad, yellowish white tips crossing both webs; greater series with similar tips a little more yellowish and confined mostly to the terminal portion of the outer webs, just reaching the inner web at the shaft. These tips on middle and greater coverts form two prominent bars across the wing; tertials and inner secondaries with a broad, yellowish white border practically around the feather, leaving only a narrow blackish hiatus at the tip. Outer margins of remainder of secondaries and primaries (except outermost primary) with a fine, yellowish white margin, obsolete on the next to outermost primary and becoming obsolete basally on the others. Scapulars black with inner webs inconspicuously grayish white; outer margins sharply and broadly yellowish white. Under wing-coverts, axillars, and narrow inner margins of remiges Barium Yellow. Maxilla blackish (in dried skin); mandible pale slaty blue at base, blacker at tip; feet dull slaty. Wing, 45 mm.; tail, 24; exposed culmen, 14; culmen from base, 16.75; tarsus, 16.25.

REMARKS.—Female with identical pattern of the male, but margins of head and neck light Tawny-Olive; mystacal stripe and its continuation on the sides of breast not so sharp nor so black; ground color of sides of breast somewhat buffy but paler than on the head; concealed patch subobsolete; under parts of body yellow as in the male and similarly without streaks, except those of the mystacal stripe and its prolongation. Wing, 45 mm.; tail, 23; exposed culmen, 13; culmen from base, 16; tarsus, 17.

The series of males measures as follows: wing, 44–45 mm.; tail, 21–24; exposed culmen, 13–14; culmen from base, 16–16.75; tarsus, 15.25–16.25.

While it is practically certain that this new bird is a conspecies of *M. sclateri*, the wide gap in the distribution of the two forms with no close relative known from the intervening area makes me hesitate to unite them at present. Relationship cannot well be with *M. b. brachyura* since it occurs at the same localities, but there is a great deal of superficial similarity between these two without causing any real danger of confusing them.

The form found in Matto Grosso, which was described by Cherrie as *Myrmotherula kermiti*, later synonymized by Dr. Hellmayr and by Mrs. Naumburg with *M. sclateri*, may prove to be entitled to reinstatement. The type and only known specimen, a female, differs markedly from five females of *sclateri* from both banks of the Rio Tapajoz. The Tapajoz birds are all quite heavily speckled with blackish on anterior under parts and flanks whereas the type of *kermiti* is sparingly marked on the breast and sides, obscurely on the flanks, and not at all on the center of the throat. Two young males of *sclateri* are also lightly marked, one slightly more and one distinctly less than the Matto Grosso skin which, however, is adult and of the other sex. The pale streaks on the top and sides of the head and the broad auriculars in the type of *kermiti* are strongly ochraceous (not so deeply colored as in *ambigua*) whereas in both sexes of typical *sclateri* the streaks are Naphthalene Yellow or Pale Chalcedony Yellow. Nevertheless, two females from the right bank of the Tapajoz have a tinge of ochraceous on the sides and top of the head though much less than in *kermiti*. The Matto Grosso bird stands out so well from the series that it seems very probable that it may prove to be distinct, though in the absence of any males and with only one female I hesitate to propose its recognition.

Specimens Examined

M. sclateri.—Brazil: Rio Tapajoz, Igarapé Brabo, 2 ♂; Igarapé Amorín, 5 ♂, 3 ♀, 1 (?) (= ♂); Caxiricatuba, 3 ♂, 1 ♀; Tauarý, 1 ♂; Piquiatuba, 3 ♂, 1 ♀. Barão Melgaço, Matto Grosso, 1 ♀ (type of *M. kermiti*).

M. ambigua.—Venezuela: Playa del Río Base, Mt. Duida, 2 ♂ (incl. type); Río Huaynía, confluence with Río Cassiquiare, 1 ♂; Solano, Río Cassiquiare, 1 ♀. Brazil: Tahuapunto, Rio Uaupés, 1 ♂.

Myrmotherula longicauda pseudoaustralis Gyldenstolpe

Myrmotherula longicauda pseudoaustralis GYLDENSTOLPE, 1930, Ark. Zool., XXI A, (26), pp. 5, 28—northeastern Perú, Moyobamba; ♀; Field Mus. Nat. Hist.

The case presented by this species is one of the most puzzling in the genus. I must confess that I am unable to agree with the solution proposed by Gyldenstolpe who separated *longicauda* and *australis* into two distinct species and assigned certain individual specimens variously to one or the other as their variable characteristics indicated their resemblances. Certain *australis* females can not be told from the type of *pseudoaustralis*, and even the males of these two forms are not always definitely separable; consequently their specific separation does not seem justifiable, and even their subspecific separation may be open to question.

A careful examination of the material at hand now leads me to believe that there are certain characters which show an average consistency and on which *pseudoaustralis* may be maintained, provided that allowance is made for a great degree of individual variation. With this allowance there will be no need to recognize two distinct species in order to account for certain specimens taken in the same localities which appear to be referable to two distinct groups. That this variation exists there is no question since no two specimens at hand from any locality are alike in detail.

The present study shows that the males of *pseudoaustralis* are separable from those of *australis* in that the white tips of the rectrices average longer, the tip of the outermost being 5–9.75 mm. (av., 7.2) as compared with 3.25–4.75 mm. (av., 4.12) in *australis*. Females may be a trifle less brightly ochraceous on the upper surface than those of *australis* but the difference is not constant, nor are the wing-bands any more whitish than in some *australis*. The white tips on the outer rectrices measure 4.75–5.50 mm. (av., 4.66) as compared with 2.75–5.50 mm. (av., 3.89) in *australis*, showing the minimum and the lowest average in *australis*.

In this characterization it is possible to associate the Vista Alegre specimens with the Moyobamba birds and to recognize *pseudoaustralis* as occupying the upper level of the Tropical Zone in Perú north of Junín. The recorded examples from Huambo and Huyabamba (or Guayabamba) undoubtedly belong here also, although, as indicated by Gyldenstolpe, they may more or less resemble typical *longicauda* of the Chanchamayo Valley. The Vista Alegre female shows an approach toward *longicauda* in the somewhat heavier streaking of the sides, but it is very deeply colored below and agrees best in other respects with the type of *pseudoaustralis*.

Three males from Zamora and Cutucuo, Ecuador, are hardly distinct from *pseudoaustralis*, only having the white margins of the upper surface rather broader than usual, though the character is variable. Without females, their identity is doubtful, though their sole characteristic opposes the criterion of darker dorsum as given for *söderströmi* of the Río Napo.

Myrmotherula longicauda longicauda Berlepsch and Stolzmann

Myrmotherula longicauda Berlepsch and Stolzmann, 1894, Ibis, (6) VI, p. 394—Chontabamba, Vitoc; ♂; Warsaw Mus.

The present form apparently is confined to the upper limits of the Tropical Zone of the Junín region. Males are more broadly margined with white above and distinctly more broadly streaked with black on the chest and sides than in either *australis* or *pseudoaustralis*. The white on the tip of the tail is broader than in *australis* but narrower than in *pseudoaustralis*. Females are decidedly less ochraceous above and below and, like the males, are more heavily streaked on the breast than either of the other two forms mentioned.

Gyldenstolpe records this form from Hauyabamba (or Guayabamba), northern Perú, and from Songo, Bolivia, but I believe that those records represent only the extremes of variation respectively in *pseudoaustralis* and *australis*.

Myrmotherula longicauda australis Chapman

Myrmotherula multostriata australis Chapman, 1923, Amer. Mus. Novit., No. 86, p. 4—Río Inambari, Perú; ♀; Amer. Mus. Nat. Hist.

The southernmost form of the species inhabits southeastern Perú and northwestern Bolivia. It is separable from *pseudoaustralis* by the minimum development of white at the tips of the rectrices in both sexes and by the average brighter ochraceous coloration of the females. Certain specimens are not clearly distinguishable and the wing-bars may be noticeably whitish, the under parts relatively pale, the streaks on the sides more pronounced than usual, or the upper parts less brightly ochraceous than ordinarily. As criteria of a geographically restricted unit, however, the characters are good.

I am quite unable to say to what form of the species may belong a male in the British Museum collected by Bartlett on the "Upper Ucayali" which has been referred by Hellmayr to *australis*. There is no other record of the species from the Amazonian lowlands; all are from the upper level of the Tropical Zone, which supports a fauna in many

instances recognizably distinct from that of the Amazonian plain, of which the Ucayali basin is a part. In this basin, *longicauda* is replaced in all other known instances by *M. surinamensis multostriata* which was described from the Ucayali. In spite of certain well-marked differences between the *longicauda* and *surinamensis* groups, I believe *surinamensis* and *longicauda* to be genetically closely related, though they may be specifically distinct today. It would be surprising to find one of the *longicauda* group inhabiting the Ucayali, but it would not be so surprising to find a specimen of *surinamensis* exhibiting some of the characters of *longicauda*. The skin in the British Museum should be examined again with the known distributional facts in mind to see if it is a true member of the *longicauda* group or an aberrant *multostriata* and, if the former, to find the subspecies to which it belongs. Since occasional other Chanchamayo Valley subspecies find their way to the Ucayali, the Bartlett skin, if it really belongs in the *longicauda* group, should belong to *M. l. longicauda* and not to *australis* as at present assigned, another reason for the re-examination suggested.

Specimens Examined

M. l. pseudoaustralis.—Perú: Moyobamba, 4♂, 3♀ (incl. type)[1]; Vista Alegre, 2♂, 1♀.[1] ?Ecuador: Zamora, 2♂; Cutucuo, Macas Region, 1♂.

M. l. longicauda.—Perú: Tulumayo, Junín, 5♂, 3♀; San Ramón, 1♂.[1]

M. l. australis.—Perú, Río Inambari, 3♀ (incl. type); Río Tavara, 2♂, 1♀; La Pampa, 2♂, 1♀. Bolivia: Locotal, Prov. Cochabamba, 1♀.

Myrmotherula hauxwelli hauxwelli (Sclater)

Formicivora hauxwelli Sclater, 1837, P. Z. S. London, XXV, p. 131, Pl. cxxvi, fig. 2—Peruv. Orientali = Chamicuros; ♂; British Mus.

Although I have no topotypes of this form, I have little hesitation in referring specimens from the Ucayali to it, in view of the proximity of the localities. The skins from the Ucayali and a single female from Teffé, Brazil, agree fairly well among themselves in being rather dull in coloration, though the Teffé bird is probably the brightest of this series. The males from the Ucayali similarly are marked by having relatively large white spots on the tips of the inner remiges and the greater and middle upper wing-coverts. In regard to those characteristics, birds of a series from north of the Amazon in Perú and eastern Ecuador show rather pronounced differences, and accordingly, I have separated this northern series as a new subspecies which is described below.

[1]Specimens in Field Museum of Natural History, Chicago.

East of Teffé, from the Rio Madeira to the Xingú, other differences are found which necessitate naming another new form from that region, also described hereunder.

If the Ucayali birds are correctly assigned to typical *hauxwelli*, this subspecies ranges through the tropical lowlands from the neighborhood of the lower Huallaga to near the mouth of the Urubamba in the Ucayali Valley, apparently being confined to the lower portions of the Tropical Zone. Records are from Chamicuros, Chyavetas, Santa Cruz (Río Huallaga), Yurimaguas, and "Upper Ucayali."

Myrmotherula hauxwelli suffusa, new subspecies

TYPE from the lower Río Suno, eastern Ecuador. No. 184,608, American Museum of Natural History. Adult female collected March 7, 1924, by Carlos Olalla and sons.

DIAGNOSIS.—Similar to *M. h. hauxwelli* but general coloration deeper in the female sex; upper surface darker but warmer, more rufous and less olivaceous brown; forehead and sides of head more strongly rufescent; lower parts deeper rufescent, especially the flanks; the dusky area between the tips of the mantle feathers and the white area deeper black; tips of upper tail-coverts deeper, more orange-tinged; middle rectrices with pale tips sometimes obsolete. Males much like those of *hauxwelli*, but pale spots on upper wing-coverts and inner remiges usually distinctly smaller; middle rectrices with pale tips smaller or lacking.

RANGE.—Eastern Ecuador and adjacent parts of Perú north of the Marañón and Amazon.

DESCRIPTION OF TYPE.—Top of head dark Brownish Olive; forehead suffused with ochraceous tawny. Back dark Brownish Olive; on the mantle a large, concealed patch of white separated from the tips by a blackish area. Sides of head deep tawny ochraceous with some dark brownish admixture on the tips of the auriculars and malar region; throat and median under parts deep Mars Yellow; sides more Sudan Brown and flanks Sudan Brown x Argus Brown. Upper tail-coverts black with tips near Ochraceous-Orange. Remiges blackish with outer margins Raw Umber; tertials with terminal spots on outer webs light Cinnamon-Buff, continued in reduced size on inner secondaries; middle and greater wing-coverts blackish (more olive brownish at base), with broad terminal areas Ochraceous-Buff, forming two conspicuous bands across the wing; lesser wing-coverts like the back, with slightly rufescent buff tips, not conspicuous. Under wing-coverts duller than the breast. Tail blackish with fine, pale buff tips, obsolete on middle pair. Wing, 53 mm.; tail, 22.25; exposed culmen, 13; culmen from base, 15; tarsus, 19.

REMARKS.—Adult males are Deep Neutral Gray x Slate Gray above, with concealed patch on mantle as in the female; Light Neutral Gray x Deep Gull Gray below with the throat somewhat paler; auriculars with a touch of whitish on shafts; upper tail-coverts black with broad white tips; under tail-coverts light gray with tips more whitish. Wings blackish; remiges margined exteriorly with gray; greater and middle

upper coverts blackish with narrow white terminal bars; lesser coverts the color of the back. Rectrices black with fine terminal spots or bars of white or whitish, sometimes obsolete on middle pair. Maxilla brownish black (in dried skins); mandible dull whitish; feet dull slate. Wing, 52.25–55 mm.; tail, 21.25–25; exposed culmen, 12–13.5; culmen from base, 15–16.25; tarsus, 18.25–21.

There is more variation among the females, some of which are more deeply colored than the type and others paler below, but all the Ecuadorian skins are recognizably distinct from the Peruvian birds. A female from Puerto Indiana, mouth of the Napo, shows an approach toward *hauxwelli* in its slightly lighter coloration, but another female from "Apayacu" (=Anayacu), a short distance to the eastward, is a typical *suffusa* and males from Puerto Indiana show the characters also of the Ecuadorian form. Skins from eastern Colombia are like the Ecuadorian birds. The young males have the pale spots on the inner remiges larger than in the adults of the same sex and tinged with buff, in which particulars they resemble the females. The adult males have these spots noticeably smaller than in adult male *hauxwelli*. A single male of the latter form is an exception, and has also small spots on the remiges though the tips of the upper wing-coverts are more broadly white than in *suffusa*, as they are in the other skins of *hauxwelli*.

Records from Iquitos and Nauta probably belong with this new form. All other Peruvian records refer to typical *hauxwelli*.

Myrmotherula hauxwelli clarior, new subspecies

TYPE from Villa Bella Imperatríz, mouth of the Rio Andirá, south bank of the Amazon (west of the Tapajoz), Brazil. No. 277,876, American Museum of Natural History. Adult female collected by the Olalla brothers, October 9, 1930.

DIAGNOSIS.—Intermediate between *M. h. hauxwelli* and *M. h. hellmayri* but possessing the white interscapular patch of *hauxwelli*. Males somewhat paler and clearer gray than *hauxwelli*, with the throat more often whitish; lesser upper wing-coverts sometimes with white terminal specks; middle rectrices always with noticeable white terminal spots, larger on outer rectrices; under tail-coverts more broadly white at tips. Females clearer than those of *hauxwelli;* upper parts lighter and clearer brown; forehead more strongly ochraceous; sides of head brighter including superciliary region; sides and flanks a little deeper than the median under parts but not at all brownish; general color of under parts similarly clearer, less clouded; lesser upper wing-coverts brighter, sometimes with still brighter ochraceous tips forming an ill-defined third band across the wing. Compared with females of *suffusa*, general coloration much paler, especially the flanks.

RANGE.—East bank of the Rio Madeira, in Brazil, eastward to the left bank of the Rio Xingú, ascending the Madeira to the neighborhood of the upper Rio Roosevelt.

Description of Type.—Top of head Brownish Olive x Light Brownish Olive; forehead tinged with Ochraceous Buff. Back light Brownish Olive with a large patch of white concealed on the mantle having a dusky area between the white and the olive tips. Lores ochraceous buff; an ill-defined superciliary line Mars Yellow x Ochraceous Tawny, darkening posteriorly; breast, sides of head, and flanks tawny Mars Yellow (Mars Yellow x Amber Brown); belly a little lighter and throat distinctly lighter with whitish bars on upper throat and chin; tips of under tail-coverts also a little paler. Remiges blackish brown, margined externally with Brussels Brown x Raw Umber, inner margins somewhat whitish, not conspicuous; tertials with a large squarish spot of buff on outer web at tip; inner secondaries with narrow buffy tips; lesser upper wing-coverts like back but with rather brighter tips, especially on lower ones where there is a semblance of an indistinct bar across the wing; greater and middle series with broad, ochraceous buff tips, forming two conspicuous wing-bars; alula with outer margins somewhat buffy; under wing-coverts orange-tinted Mars Yellow. Tail blackish with buffy white tips, broadest on outer feathers; upper tail-coverts blackish brown with broad ochraceous tips. Maxilla blackish; mandible dull whitish; feet dull brown. Wing, 52 mm.; tail, 24; exposed culmen, 13; culmen from base, 15.5; tarsus, 19.5.

Remarks.—Two females from near Borba are somewhat more rufescent above and below than the rest of the series, with the forehead proportionately more conspicuous, but both are apparently immature. The same variation is perceptible in the series of *hellmayri*. Examples from west of the Rio Madeira are somewhat intermediate between *hauxwelli* and *clarior* but, except for a young female, are closer to *clarior*, the western limit of whose range may be the Rio Purús.

Although this form is distinctly intermediate between *hauxwelli* and *hellmayri*, it occupies such an extent of territory that it deserves to be recognized under a separate name. Three males from the Rio Roosevelt, Matto Grosso, are not certainly recognizable without females from the region, but on geographical grounds presumably belong to *clarior*.

The obvious representative of this species north of the Amazon in eastern Brazil, Venezuela, and the Guianas is *M. guttata*, but the differences in both sexes are such that I am unable to place them in the same species at present.

Specimens Examined

M. h. suffusa.—Ecuador: lower Río Suno, 4 ♀ (incl. type); Río Suno, above Avila, 2♂, 1♀; mouth of Río Curaray, 3♂, 2♀. Colombia: "Bogotá," 1♀; Villavicencio, 1♀; La Morelia, 2♀. Perú: Puerto Indiana, 2♂, 1♀; Apayacu (=Anayacu), 1 ♀.

M. h. hauxwelli.—Perú: Santa Rosa, Río Ucayali, 3♂; Lagarto, Río Ucayali, 6♂, 6♀; Sarayacu, 1♂. Brazil: Santo Isidoro, Teffé, 1♀.

M. h. clarior.—Brazil: Rosarinho, Rio Madeira, 3♂, 3♀; Borba, 2♂; Santo Antonio de Guajará, 1♂; Igarapé Auará, 1♂, 2♀; Calamá, 1♂; Villa Bella Imperatríz, 6♂, 4♀ (incl. type); Caxiricatuba, Rio Tapajoz, 1♂, 1♀; Igarapé

Brabo, Rio Tapajoz, 4♂; Igarapé Amorín, 1♀; Tauarý, 1♀; Rio Roosevelt, "Camp 8," 2♂, 1 "♀" [=♂].

M. h. hellmayri.—BRAZIL: Utinga, near Pará, 2♂, 2♀; Ananindeua, 1♂, 1♀; Mazagao, Rio Tocantins, 1♂; Villarinho do Monte, Rio Xingú, 1♂, 5♀; Porto do Moz, 1♂; Tapará, 1♂.

Myrmotherula haematonota haematonota (Sclater)

Formicivora haematonota SCLATER, 1857 (June), P. Z. S. London, XXV, p. 48—Chamicuros, eastern Perú, ♂ juv.; British Mus.

A series of six males and two females from the lower Ucayali and the south bank of the Amazon, below the mouth of the Ucayali, seem to represent typical *haematonota*. The males are fairly consistent, having a varying amount of ochraceous tinge on the tips of the upper wing-coverts. One specimen from Orosa, younger than the others, has the Mahogany Red of the mantle a little duller and withdrawn from the upper tail-coverts which are olive-brown, but the spots on the wing-coverts are no more buffy than in some of the other specimens. A still younger bird from Sarayacu, sexed as a male, is not appreciably different from an adult female from Orosa except for fluffier plumage and duller colors. The throat is distinctly white with blackish lateral margins of the feathers strongly apparent giving a streaked appearance to the area. The top of the head is lighter brown than in the adult males and the tail a little less dusky brown. The spots on the wing-coverts are buffier than in the male.

Another female from Orosa is somewhat different and has the throat less whitish (though whiter than the breast) and only faintly streaked with dusky. The rufous of the back is somewhat darker and the lower under parts are brighter buffy, less tinged with grayish. The spots on the upper wing-coverts are deeper in color, with those on the middle and greater series somewhat rufescent.

A female from Yurimaguas, in the collection of Field Museum of Natural History, is not matched exactly by any of the Ucayali or Orosa birds, being distinctly paler brown above, with the rufous area on the mantle paler and duller, and with the ground color of the upper wing-coverts dusky brown but hardly blackish. The plumage is rather fluffy though the bird appears to be adult, and the general impression is that of an undeveloped individual. Taczanowski discusses a possibly young male also from Yurimaguas, with apparently similar characteristics, differing from other Yurimaguas skins before him.

A male and a female from Puerto Indiana at the mouth of the Napo, on the north bank of the Amazon, are not perfectly identical with the

birds from the south bank. The male has the gray of the under parts as dark as in *spodionota*, with the brown of the flanks correspondingly deepened. The back, however, is Mahogany Red of a slightly lighter tone than in the south-bank Peruvian skins and approaches the hue of a male from near Borba, Brazil. The female is a deeper ochraceous buff below than are the Orosa females, especially on the throat, with only the chin white but with heavy dusky lines as in one Orosa bird. The back is very little lighter rufous than in the Orosa specimens. In ventral coloration this female stands exactly between two of three females from Teffé, Brazil, one of which is slightly darker, the other slightly brighter.

I am constrained to recognize *amazonica* (described by Ihering from the Rio Juruá) as a distinct subspecies on the basis of three males—one from the east bank of the Rio Madeira, near Borba, one from the left bank, and one from Teffé. These three birds agree with each other and differ from *haematonota* by reason of paler gray breast, brighter brown crown, and brighter rufous back, with the forehead and lores rather paler, more silvery gray. The brown of the flanks is a little brighter, more ochraceous and less grayish (warm Light Brownish Olive instead of Brownish Olive). A female from the left bank of the Madeira has also a noticeably light rufous back, while the three females from Teffé are a little darker, though not so dark as the series from Perú. On the under side, the Madeira bird is much like the buffy-throated female from Orosa, and one of the Teffé skins is similar, with a little less tinge of white on the throat. The other two Teffé females are much darker below, more deeply ochraceous on the throat where there are strong dusky margins, and more grayish brown on the flanks and belly, resembling the Puerto Indiana female as mentioned above.

Furthermore, I believe that *pyrrhonota* from the upper Rio Negro, Brazil, is equally deserving of recognition, though on quite other grounds than those proposed by its describer. There are sixty-one specimens before me from the Rio Negro and the Rio Uaupés, Brazil, the Cassiquiare, the upper Orinoco, the foot of Mt. Duida and the Caura Valley, Venezuela, and the Caquetá region of Colombia. Compared with *haematonota*, the males are brighter and clearer Mahogany Red on the back; paler gray on the chest; brighter brown on the flanks and crissum (bright Dresden Brown instead of Brownish Olive); lighter, warmer brown on the remiges and rectrices; and with somewhat broader white terminal spots on the throat.

The females are deeper, more orange-tinged ochraceous below than those of any other subspecies; breast deep cinnamomeous Clay Color,

darkening to Saccardo's Umber x Tawny Olive on flanks and crissum. Sides of head correspondingly brighter ochraceous, invading the forehead; top of head brighter ochraceous brown, with ochraceous shaft streaks on anterior part of crown; throat usually without well-defined dusky margins on the feathers and these, when present, not conspicuous. Rufous of back sometimes as deep as in females of *haematonota* but usually brighter.

As pointed out long ago by Hellmayr (Novit. Zool., XIV, p. 71, 1907) the extent of rufous on the back and the amount of buff in the apical spots of the upper wing-coverts of the males are variable characters presumably due to age.

Returning to the Puerto Indiana skins, I find it possible to match very closely the upper parts of both specimens with examples of *pyrrhonota*. Beneath, this resemblance is lacking. The dark color of the male may be due to the influence of *spodionota* and is far from the hue of *pyrrhonota*. The female similarly does not resemble *pyrrhonota* in the color of the under parts but is more like the Teffé females of *amazonica*. More material from this region is extremely desirable to settle the affinities of the resident form. For further remarks on nearby localities, see below under *M. h. sororia*.

A careful study of all the various forms assigned by Dr. Hellmayr to *haematonota* and *leucophthalma* forces me to disagree with the allocation of subspecies as proposed by him. The principal difference of opinion lies in the value which may be placed in the presence or absence of a rufous patch on the back as a specific character. The material now before me strongly suggests that the rufous patch is not a specific character and that a better arrangement of forms is obtained when this feature is reduced to subspecific value. The two species are then left, each with both types of coloration. An added value is given to this arrangement by the fact that the same sort of divergence within the species can be shown in the case of *M. ornata* as will be demonstrated in the second part of this paper under the discussion of that species.

In the search for the real specific characters separating *leucophthalma* and *haematonota*, the most striking feature to be seen is that of the markings on the upper wing-coverts. In *haematonota* the pale tips are smaller and more rounded; those of the greater and lesser series form two rows of spots across the wing. In *leucophthalma* the tips are broad and those of the greater and lesser series form two broad bands across the wing. The smallest lesser coverts of *haematonota* are blacker; in *leucophthalma* they are gray. The tail of *leucophthalma* is a little

longer and more slender and is brighter rufous than in *haematonota.* These differences are no more than might be considered subspecific if there were no conflicts in distribution, although they are positive enough to identify all the specimens which I have at hand. Those of *haematonota* are shared by *sororia, spodionota, amazonica,* and *pyrrhonota;* those of *leucophthalma* by *sordida* and *phaeonota.* Possibly it may be found advisable at some future time to unite the two groups specifically. Until such time the two species should be arranged as indicated here.

The arrangement proposed here is further deemed advisable because of the apparent conflict in the ranges of some of the forms of the two groups. *M. haematonota* (? = *amazonica*) has been recorded by Snethlage from Cachoeira, Rio Purús (right bank), while *leucophthalma* has been recorded by Ihering from Bom Lugar, Rio Purús (right bank) and by Todd from Hyutanahân (? left bank). These records need careful reexamination since the male of *leucophthalma* at hand from the Rio Roosevelt has decided rufous areas on some of the lower mantle feathers not shown by another male from the same locality nor by a female from a little lower down the same stream. It seems probable that the appearance of rufous on the specimen mentioned signifies the intergradation of *leucophthalma* and *phaeonota* in this region. A young female of *phaeonota* from Borba shows a decided reduction in the dorsal rufous patch greatly resembling the Rio Roosevelt male. Others from near Borba are decidedly variable in the same respect. There is a specimen in female plumage, but without indicated sex, from the left bank of the Tapajoz (Igarapé Brabo) which has no rufous on the back and thereby resembles *sordida* of the right bank instead of *phaeonota* of which there are various skins from Igarapé Brabo. It might be argued, therefore, that this occurrence necessitates keeping *phaeonota* and *sordida* specifically distinct, since they occur together. However, the demonstrable reduction in the amount of rufescence which is exhibited elsewhere in the range of *phaeonota* proves the instability of this character and makes it possible that the single Igarapé Brabo bird is aberrant, approaching *sordida* to the point of identity. There is also the possibility of an error in the labeling of this single skin.

Myrmotherula haematonota sororia Berlepsch and Stolzmann

Myrmotherula sororia Berlepsch and Stolzmann, 1894, Ibis, (6), VI, p. 396—La Gloria and La Merced; type from La Gloria; ♂; Warsaw Mus.

A male from La Merced unquestionably represents this form. A second male from the Río Negro, west of Moyobamba, is slightly different,

with a little greater proportion of gray in the grayish olive brown of the back, thereby approaching *spodionota* somewhat closer. Taczanowski recorded three specimens from Huambo but assigned them to *M. gutturalis* of British Guiana whose nearest ally in Perú I take to be *M. erythrura,* to which Taczanowski's description of the Huambo specimens cannot possibly apply. The description of the upper wing-coverts as rufous brown instead of black, save for the buffy tips, does not agree with *sororia,* as a matter of fact, but in other respects the diagnosis cannot apply to any other species of the genus known to me from Perú, and the record may be left here for the present.

Taczanowski also recorded a skin from the Río Tigre, Perú (north of the Amazon) which he assigned also to *gutturalis* though with notes that indicate a better agreement with *sororia* than shown by the Huambo skins. Dr. Hellmayr has examined this skin and refers it to *sororia,* but I am somewhat doubtful as to the correctness of this assignment. Specimens from the mouth of the Napo are referable to *haematonota* and a female from Zamora, Ecuador, is not distinguishable from *spodionota* from the Río Suno (described from Sarayacu, Río Bobonaza). The gray or grayish brown-backed birds seem to be restricted to the more elevated portions of the Tropical Zone while the rufous-backed ones are found relatively lower. Consequently it seems unlikely that *sororia* or *spodionota* should exist on the part of the Río Tigre which flows through Perú. It is much more likely that the Río Tigre specimen should be like a skin which I have from the mouth of the Río Curaray, between the Suno and the mouth of the Napo. This bird, a hardly adult male, is neither *haematonota* nor *spodionota,* but rather suggests an intermediacy between them. The top of the head is warm Dresden Brown, as in *sororia,* with the upper mantle the same, while the lower mantle and rump approach Prout's Brown. This color is much warmer than the Grayish Olive of *sororia* but is far from the Mahogany Red of *haematonota.* It is apparently not entirely due to immaturity. Immature males of *haematonota* show distinct, though dull, Mahogany Red on the back. One nearly adult male of *spodionota,* on the other hand, has a few warm brown feathers on the back that have not yet been molted, but the head is only tinged with brown, the flanks are deep brown, and the breast relatively dark gray; in these respects the Curaray skin is closer to *haematonota.*

I believe, therefore, that *haematonota* and *spodionota* intergrade somewhere between the lower Napo and the upper limit of the Tropical Zone in Ecuador and that the Río Tigre and Curaray skins are inter-

mediate. Certainly I am loath to extend the range of *sororia* so far from its apparently logical limits as to include these two localities.

SPECIMENS EXAMINED

M. h. haematonota.—PERÚ: Sarayacu, Río Ucayali, 3 ♂; Orosa, Río Amazonas, 3 ♂, 2 ♀; Puerto Indiana, 1 ♂, 1 ♀; Yurimaguas, 1 ♀.[1]

M. h. amazonica.—BRAZIL: Teffé, Boca Lago, 1 ♂, 2 ♀; Teffé, Santo Isidoro, 1 ♀; Rosarinho, Rio Madeira (left bank), 1 ♂, 1 ♀; Santo Antonio de Guajará, 1 ♂.

M. h. sororia.—PERÚ: La Merced, 1 ♂; Río Negro, about 35 miles west of Moyobamba, 1 ♂; Vista Alegre (junction of Chinchao and Huallaga rivers), 1 ♂[1]; Huachipa (across the Chinchao from Vista Alegre), 1 ♀.[1]

M. h. spodionota.—ECUADOR: Río Suno, above Avila, 5 ♂, 1 ♀; below San José, 5 ♂, 2 ♀; Zamora, 1 ♀; [mouth of Río Curaray, 1 ♀].

M. h. pyrrhonota.—BRAZIL: Tatú, Rio Negro, 4 ♂, 6 ♀; Tabocal, 1 ♀; Yavanari, 1 ♀; Muirapinima, 1 ♂; Tahuapunto, Rio Uaupés, 3 ♂, 6 ♀. VENEZUELA: Solano, Río Cassiquiare, 1 ♀; El Merey, 1 ♀; opposite El Merey, 4 ♂, 1 ♀; mouth of Río Ocamo, 4 ♂, 4 ♀; opposite mouth of Ocamo, 1 ♂, 3 ♀; Playa del Río Base, Mt. Duida, 1 ♂, 1 ♀; Caño León, 1 ♂, 1 ♀; foot of Mt. Duida, 1 ♂, 1 ♀; Río Pescada, 2 ♂, 1 ♀; Boca de Sina, Río Orinoco, 2 ♂, 1 ♀; "Caura River," 1 ♀; La Union, 2 ♂; Suapuré, 2 ♀. COLOMBIA: La Morelia, 1 ♂.

M. l. leucophthalma.—BRAZIL: "Camp 8," Roosevelt River, 2 ♂; "Camp 14," 1 ♀.

M. l. phaeonota.—BRAZIL: Borba, Rio Madeira (right bank), 3 ♀; Igarapé Auarí, 1 ♂, 2 ♀; Villa Bella Imperatríz, Serra Parintins, 1 ♂, 1 ♀; Lago Andirá, 2 ♂; Limontuba, Rio Tapajoz (left bank), 1 ♂; Igarapé Brabo, 3 ♂, 2 ♀; Igarapé Amorín, 1 ♂, 1 ♀; Limoãl, 1 ♀; Villa Braga, 1 ♂; Pinhel, 1 ♀.

M. l. sordida.—BRAZIL: Caxiricatuba, Rio Tapajoz (right bank), 6 ♂, 3 ♀; Tauary, 3 ♂, 2 ♀; [?Igarapé Brabo (left bank), 1(?) (= ♀)]; Arumatheua, Rio Tocantins, 1 ♂; Cametá, 1 ♀; Porto do Moz, Rio Xingú, 1 ♂, 1 ♀; Villarinho do Monte, Rio Xingú, 1 ♂.

[1]Specimens in Field Museum of Natural History, Chicago.

AMERICAN MUSEUM NOVITATES

Number 524 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | April 26, 1932

59.88, 1 M (85)

STUDIES OF PERUVIAN BIRDS. IV

THE GENUS *MYRMOTHERULA* IN PERU, WITH NOTES ON EXTRALIMITAL FORMS. PART 2

BY JOHN T. ZIMMER

Myrmotherula ornata atrogularis Taczanowski

Myrmotherula atrogularis TACZANOWSKI, 1874, P. Z. S. London, p. 137—Amable Maria; ♂; type formerly in Warsaw Mus., now lost.

The original description of the females of this race from Monterico indicates the upper surface to be distinctly grayish, though tinged with brown, and the author's more complete description in the 'Ornithologie du Pérou' (p. 41) adds still further to this impression. Sharpe's description of his *Myrmotherula guayabambae* distinctly notes the gray dorsum of the females. The birds I collected in the upper Huallaga Valley agree with this diagnosis; the females have the upper surface noticeably grayish though washed with olivaceous or brownish. Hellmayr's comparison of the type of *guayabambae* and a specimen from Huambo also mentions this character. All these localities, including the type locality, are in the drainage of the Huallaga and Ucayali, and it seems probable that a single form is here represented. A male at hand from Santa Rosa, upper Ucayali, should belong to the same form for which *atrogularis* is the older name.

Females from southeastern Perú and northern Bolivia, in the drainage of the Madeira and its tributaries, have the back distinctly more brownish with the forehead brighter and more olivaceous, and seem to represent a previously unnamed form which is described below.

I believe that no good purpose is served in keeping *atrogularis* in a species apart from *ornata*. The principal difference between the two is in the presence or absence of the rufous "saddle" which is a variable feature also in the *haematonota* group and does not appear to be of full specific value. The females of *atrogularis* show the same gular pattern as *ornata ornata* and *o. saturata* to which they are closer in that respect than is *o. hoffmannsi* though it possesses the rufous "saddle" that *atrogularis* lacks. Taken together, the four forms here considered as conspecies form a fairly compact and homogenous group without any overlapping

of ranges though with some unfilled gaps in the known distribution, which may be filled when our knowledge of the intervening areas is greater.

Myrmotherula ornata saturata (Chapman)

Myrmopagis ornata saturata Chapman, 1923, Amer. Mus. Novit., No. 96, p. 9—Upper Suno River, e. Ecuador; ♂; Amer. Mus. Nat. Hist.

A female of this form, collected by Carlos Olalla and sons at Puerto Indiana, is the only example known from Perú. This specimen is now in the collection of the Academy of Natural Sciences of Philadelphia. Through the kindness of Dr. Stone, I have been enabled to examine the specimen which is a typical example of the east-Ecuadorian form.

Myrmotherula ornata meridionalis, new subspecies

Type from the Río Tavara, southeastern Perú; altitude 1600 feet. No. 132 715, American Museum of Natural History. Adult female collected May 28, 1915, by H. and C. Watkins; original number 143.

Diagnosis.—Nearest to *M. o. atrogularis* of northern Perú, south of the Marañón, and males not clearly distinguishable, but females distinctly browner above, with the forehead brighter and more ochraceous.

Range.—Southeastern Perú and northwestern Bolivia; Tropical Zone.

Description of Type.—Back Light Brownish Olive x Brownish Olive[1]; crown and nape a little darker; forehead brighter, strongly tinged with deep Ochraceous Buff; rump and upper tail-coverts a little brighter than the back, Light Brownish Olive x Dresden Brown. Lores, superciliary region, malar region, and anterior portion of auriculars bright Orange-Buff x Ochraceous Buff; posterior auriculars darker, more olivaceous. Chin and throat black with broad wedge-shaped tips of white; breast bright Orange-Buff x Ochraceous Buff; sides and flanks duller and browner; belly lighter; crissum like flanks. Remiges Hair Brown with outer margins more olivaceous; greater upper wing-coverts Dark Grayish Olive, more blackish subterminally, and tipped rather broadly with white, slightly buffy on the innermost feathers; middle and lesser coverts sooty with white tips; under wing-coverts and inner margins of remiges whitish, slightly tinged with buff; bend of wing ochraceous. Rectrices dark Hair Brown with slightly brighter margins; tail rounded, outer rectrices 8.5 mm. shorter than middle ones. Wing, 52 mm.; tail, 37; exposed culmen, 12.5; culmen from base, 16.5; tarsus, 16. "Iris brown; bill blue-black; feet slate."

Remarks.—Males above Neutral Gray x Deep Neutral Gray; breast Neutral Gray x Light Neutral Gray; malar region Pallid Neutral Gray; lores and auriculars a little darker; belly paler, more whitish; flanks and crissum Light Brownish Olive; middle of belly sometimes more buffy. Tail and wings dark Hair Brown, with pale grayish outer margins; upper wing-coverts black with white tips which are more rounded on the middle and lesser series; wing lining white. Wing, 51–

[1]Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

52 mm.; tail, 36–38.25; exposed culmen, 12–13.5; culmen from base, 15.25–16; tarsus, 16–17.

The approach toward *hoffmannsi*, indicated by the brown-backed females, is suggestive of a probable connection of the ranges of this form and *meridionalis* by way of the upper Rio Madeira, though no material is at hand from that region to substantiate this conjecture.

SPECIMENS EXAMINED

M. o. ornata.—COLOMBIA: "Bogota," 2♂; Buena Vista, 2♂, 1♀.

M. o. saturata.—ECUADOR: Río Suno, above Avila, 2♂ (incl. type), 2♀; lower Río Suno, 2♂, 2♀; below San José de Sumaco, 1♂, 3♀; mouth of Río Curaray, 10♂, 2♀; (Río) Napo, 2♀; Zamora, 2♂, 1 (?), 1♀. PERÚ: Puerto Indiana, 1♀.[1]

M. o. atrogularis.—PERÚ: Vista Alegre, 2♂[2]; Huachipa, 3♀[2]; Santa Rosa, upper Ucayali, 1♂.

M. o. meridionalis.—PERÚ: Río Tavara, 1♂, 1♀ (type); Astillero, 1♂, 2♀; La Pampa, 2♂, 1♀. BOLIVIA: Mission San Antonio, Río Chimoré, 1♀.

M. o. hoffmannsi.—BRAZIL: Rio Tapajoz, Caxiricatuba (right bank), 4♂, 2♀; Piquiatuba, 2♂, 1♀; Aramanay, 1♂; Rio Tocantins, Arumatheua, 1♂, 1♀; Rio Roosevelt, "Camp 17," 1♂.

Myrmotherula erythrura erythrura Sclater

Myrmotherula erythrura SCLATER, 'Cat. B. Brit. Mus.,' 1890, XV, pp. 230, 236, Pl. xv—Río Napo, Ecuador; ♀; British Mus.

A female from Puerto Indiana and two of the same sex from Apayacu (=Anayacu), both localities north of the Amazon, agree with a series from the Río Suno in Ecuador which represents typical *erythrura*. A female topotype is at hand but is very old and "foxy" so that it is not to be matched exactly by any of the others. A number of males from eastern Ecuador also are at hand and a pair from Tatú, Brazil, at the junction of the Rio Negro and the Rio Uaupés. The latter locality furnishes an extension of range for the species, not heretofore recorded from Brazil.

The females all agree well with each other in having the sides of the head and breast distinctly grayish brown, varying from dusky Drab or Hair Brown to Deep Mouse Gray on the auriculars; the sides of the breast are sometimes a little browner. The forehead also is grayish brown or even gray. The Puerto Indiana bird is the darkest of all in these respects.

Eight females from the Ucayali in Perú, south of the Amazon, show a noticeable difference in the more ochraceous tone of the sides of the

[1]Specimen in Academy of Natural Sciences, Philadelphia.
[2]Specimens in Field Museum of Natural History, Chicago.

head and breast. They agree in that respect with four females from the Río Pichis in the collection of Field Museum of Natural History, which I discussed in an earlier paper (Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 329, 1930). The amount of material now at hand is sufficient to make the separation of the southern form advisable, and it is described below.

In spite of certain rather abrupt differences between *gutturalis* of British Guiana and *erythrura*, I believe that these two species are closely related. In the long, slender tail, the style of spotting on the wing-coverts, the coloration of the lower under parts, the shape of the bill, and other smaller details, there is quite close approximation, especially with the females, and though I am not ready to unite the two groups specifically I believe that they should stand adjacent in the catalogues.

Myrmotherula erythrura septentrionalis, new subspecies

Type from Santa Rosa, upper Río Ucayali, Perú, No. 240,273, American Museum of Natural History. Adult female collected November 29, 1927, by Carlos Olalla and sons.

Diagnosis.—Similar to *M. e. erythrura* from southeastern Ecuador but females separable by having the sides of the head and breast and the forehead ochraceous instead of gray or grayish brown; wing lining averaging slightly less pinkish buff; rufous of back inclined to be less extended anteriorly and somewhat paler in tone. Males not clearly distinguishable from those of *erythrura* but wing lining averaging slightly less pinkish buff; pale spots on upper wing-coverts usually smaller and whiter, less buffy; rufous of back inclined to be paler and less extended over the anterior part of mantle; gray of breast inclined to be paler: throat inclined to be whiter.

Range.—Eastern Perú and western Brazil, south of the Amazon, from the Ucayali (both banks) south to northern Puno and east to Teffé, Brazil.

Description of Type.—Top of head Isabelline Dresden Brown; fore part of mantle darker (Dresden Brown x Light Brownish Olive); lower part of mantle bright rufescent (Sanford's Brown x Burnt Sienna); rump and upper tail-coverts somewhat paler and browner (Amber Brown). Lores dull Isabella Color; malar region and auriculars slightly darker but ochraceous, not grayish in tone; chin and throat deep Ochraceous-Buff; breast duller, approaching Cinnamon Buff, which darkens laterally and merges on the sides with the color of the anterior part of mantle; belly duller and paler; flanks and crissum browner (Isabella x Light Brownish Olive). Remiges fuscous, margined externally with olive-brown, more grayish at the base and more rufescent terminally and on the tertials; upper wing-coverts light olive-brown with triangular terminal spots of buffy white, largest on greater series, small but distinct on the lesser ones; wing lining light pinkish buff. Tail much graduated; external rectrices not much longer than under tail-coverts; rectrices Auburn x Sanford's Brown, margined exteriorly at base with an olive brownish tinge; all but median pair faintly dusky subterminally and finely tipped with a pale point. Bill black, tip of mandible whitish (dried skin); feet pale brownish. Wing, 55 mm.; tail, 41.5; exposed culmen, 10.5; culmen from base, 14.25; tarsus, 16.

REMARKS.—Males above much like the females but darker; forehead more grayish; sides of head, including superciliary region, pale gray; throat variable, grayish white to pale gray with or without visible blackish borders near the bases of the feathers; breast and sides Pale Neutral Gray to Light Neutral Gray; upper belly inclined to paler gray; lower flanks and crissum Isabella Color x Light Brownish Olive. Lesser and median upper wing-coverts Deep Mouse Gray, the greater series more olivaceous brown, all with a triangular terminal spot of whitish; primary-coverts with or without a tiny white spot at tips (in young birds the tips of the greater coverts are tinged with buffy). Wing-lining and tail as in the female. Bill blackish (in dried skins); feet dull, pale brown, the toes darker. Wing, 52–55 mm.; tail, 38–41; exposed culmen, 11–12.5; culmen from base, 15–16; tarsus, 15–16.5.

In typical *erythrura,* most of the males have distinct darker marginal markings on the central throat feathers toward their bases, in some cases decidedly blackish, giving the throat an obscurely streaked appearance. In a few skins these markings are obsolete. In *septentrionalis* the ground color of the throat averages a little paler with the dark markings more frequently obsolete and never as blackish nor as heavy as in the most extreme *erythrura.* The character, therefore, is of some value in the separation of the new race, though not of constant importance. Several of the males of *septentrionalis* have the greater upper wing-coverts buffy but in every such case this row of coverts appears to be part of the immature plumage. Not only are the tips buffy but the webs in general are rather rufescent brown than grayish and there is a corresponding immaturity shown by the brown, instead of grayish, primary-coverts which are marked by cinnamomeous terminal spots that are absent in fully adult birds. Even in these birds there is little indication of buff on the spots of the middle and lesser coverts. In typical *erythrura,* however, the adult males have the greater coverts noticeably buffy, and even the middle and lesser series are frequently also tinged with buff, especially in young birds. If adults only are used for comparison, this character also seems to be of value.

Three females from Teffé, Brazil, are like the Ucayali birds, though one of them shows perhaps the nearest approach to typical *erythrura* of any of the series.

The Yahuarmayo record by Hellmayr (Arch. Naturg., LXXXV, A, (10), p. 97, 1920) belongs with this new form.

Specimens Examined

M. e. erythrura.—Ecuador: (Río) Napo, 1 ♀; Río Suno, above Avila, 3♂, 3♀; lower Río Suno, 3♂; below San José, 2♂, 2♀; mouth of Río Curaray, 2♂, 3♀. Perú: Puerto Indiana, 1♀; Apayacu, 2♀. Brazil: Tatú, Rio Negro, 1♂, 1♀.

M. e. septentrionalis.—Perú: Santa Rosa, upper Ucayali, 10♂, 7♀ (incl. type); Lagarto, upper Ucayali, 1♂; Puerto Bermúdez, Río Pichis, 1♂[1], 4♀[1]; La Pampa, Río Tavara, 2♂, 1♀. Brazil: Boca Lago, Teffé, 3♀.

M. gutturalis.—British Guiana: Tumatumari, 2♂; Potaro Landing, 1♀; Minnehaha Creek, 1 "♀" (=♂). Brazil: Obidos, 1♂; Faro, 4♂, 7♀.

Myrmotherula axillaris melaena (Sclater)

Formicivora melaena Sclater, 1857 (October), P. Z. S. London, XXV, p. 239—Bogotá; ♂; British Mus.

Birds from Puerto Indiana, at the mouth of the Napo, are quite distinctly referable to *melaena* and agree well with a large series from eastern Ecuador, upper Rio Negro in Brazil, upper Orinoco region of Venezuela, and eastern Colombia. This series shows *melaena* to be extremely variable within certain limits. Some of the males are not to be distinguished clearly from *albigula* of Central America and western Colombia and Ecuador, being deep glossy black except for the characteristic white markings. Others of the series are decidedly duller and sootier, and some develop a noticeably grayish tone above through the acquisition of faint gray fault bars on the distal portion of the feathers of the head and back. As a rule, however, there is no strong demarcation between the throat and the sides of the head although it sometimes occurs throughout the range.

The females vary in the warmth of the brown color on the back and the depth of the ochraceous color beneath. The throat is usually noticeably whitish. I can find no recognizable differences in the series mentioned which includes specimens from both banks of the upper Rio Negro as far east as the vicinity of Santa Isabel. East of the Rio Branco, *axillaris* occurs on both banks of the Negro and thence south to the Amazon which it crosses to enter the region on both banks of the lower Madeira, thence ranging southward to northwestern Matto Grosso, at least on the east bank of the Gy-Paraná.

South of the Amazon and Marañón rivers in Perú and western Brazil (Teffé), the birds are usually easily referable to *melaena,* but an occasional male is a little grayer than any of the northern examples. The females are all of the *melaena* plumage. What the upper Juruá and Purús examples may be, I cannot say without material from those

[1]Specimens in Field Museum of Natural History, Chicago.

regions. They have been assigned to *axillaris* by Hellmayr and others who have examined them, and are evidently of a gray-backed form. Skins that I have from Perú on the lower Ucayali are inseparable from *melaena*, though others are reported by Hellmayr to be closer to *axillaris*. It is evident, therefore, that a considerable area of transition exists in which both extremes of masculine plumage may occur, and the upper Juruá and upper Purús may belong in this area.

From farther up the Ucayali, all the males I have are definitely gray-backed, resembling *axillaris*, but still more closely resembling Bolivian birds in that the under tail-coverts are usually much more blackish and more sharply and narrowly tipped with white. The females, however, remain closer to *melaena* and are separable from *axillaris* females by much the same characters as *melaena*. We thus have the curious circumstance of a region in which the males are almost identical with one subspecies and the females with another. They are not simple intermediates, for one sex of each adjacent form is practically intact. Consequently, I believe it justifiable to name this form in which two forms are seemingly "mismated."

Myrmotherula axillaris heterozyga, new subspecies

TYPE from Santa Rosa, upper Río Ucayali, Perú. No. 240,259, American Museum of Natural History. Adult female collected December 3, 1927, by Carlos Olalla and sons.

DIAGNOSIS.—Female almost indistinguishable from *M. a. melaena* females but inclined to be a trifle grayer above, less brownish. Separable from *axillaris* females by being decidedly grayer on the upper surface, with the outer margins of the remiges and rectrices duller and less deeply rufescent, and the throat usually less whitish. Compared with *lafresnayana*, the females are distinctly less deeply ochraceous below with the throat and sides of head more whitish. Males nearly indistinguishable from males of *M. a. lafresnayana* but inclined to be slightly darker gray above; much paler than *melaena*; white tips of rectrices sometimes absent and never very large.

RANGE.—The upper reaches and tributaries of the Río Ucayali, eastern Perú.

DESCRIPTION OF TYPE.—Crown, back of head and neck, and mantle slightly grayer than Brownish Olive; forehead Light Brownish Olive; lower back slightly browner; upper tail-coverts brighter, more cinnamomeous. Lores whitish, tinged with buff; a barely distinguishable superciliary stripe light buffy; auriculars like crown at tips but with shafts rather conspicuously whitish; malar region pale ochraceous; throat white basally but with tips of feathers pale ochraceous, giving the area the appearance of being buffy white; breast and belly pale clay color; sides of breast browner, merging into the color of the back; flanks and axillaries silky white largely concealed by ochraceous tips; under tail-coverts bright Sudan Brown x Mars Yellow. Remiges Fuscous; exterior margins Sayal Brown x Tawny Olive; inner margins Pinkish Buff; upper wing-coverts similar with rather broad tips of cinnamomeous

Clay Color becoming obsolete on the lesser series; under wing-coverts orange-tinted Ochraceous Buff on outer portion but becoming white toward the humeral angle and merging with the white of the axillaries. Tail Fuscous with brighter rufescent brown margins. Wing, 50.75 mm.; tail, 34; exposed culmen, 12.25; culmen from base, 15.5; tarsus, 16.

REMARKS.—Males Deep Neutral Gray x Dark Neutral Gray above, rather lighter on sides of head and sides of breast; median under parts, from chin and throat to crissum, black; flanks and wing-lining silky white; under tail-coverts black with relatively narrow white tips; upper tail-coverts usually distinctly blackish; lesser upper wing-coverts at radial margin of wing, and outer border of scapulars white forming a large patch which may be more or less concealed; submargins of scapulars blackish; remainder of upper wing-coverts black with white tips which are usually rounded. Remiges sooty blackish with outer margins or submargins deeper in color and margins occasionally very narrowly touched with white. Tail black, sometimes with narrow white tips on outermost two or three pairs, sometimes without white. Wing, 51.5–57 mm.; tail, 33–37; exposed culmen, 12.25–13; culmen from base, 15–16; tarsus, 15–16.

Female type and paratypes measure: wing, 48–53.75 mm.; tail, 32–37; exposed culmen, 12.25–12.75; culmen from base, 15.5–16; tarsus, 15.75–16.

I must confess that the differences indicated in the diagnosis are so slight that in the absence of one or the other sex I would not attempt to separate the present subspecies from *lafresnayana* on the one hand, or from *melaena* on the other, though the characters exist as described. Nevertheless, with both sexes in hand it is quite impossible to refer these birds to either of the adjacent forms. The transition between the females of *heterozyga* and *lafresnayana* should take place, if anywhere, on some of the affluents of the upper Purús or Madre de Dios, a rather roundabout way, since there is no more direct and uninterrupted connection at present. The connection with *melaena* is much more direct, granted that the Marañón is not an effective barrier in the present instance

The upper Ucayali males are relatively quite uniform and distinct from most of the males found along the south bank of the Marañón and upper Amazon and the lower Ucayali rivers. These latter birds are far from uniform though most of them are clearly referable to *melaena;* several skins approach *heterozyga* quite closely.

Myrmotherula axillaris lafresnayana D'Orbigny and Lafresnaye

T(hamnophilus) Lafresnayanus D'ORBIGNY AND LAFRESNAYE, 1837, Mag. Zool., VII, cl. II, p. 13—Yuracares (Rep. Boliviana); ♀; Paris Mus.

A female from Astillero, southeastern Perú, agrees perfectly with a series of Bolivian females that are recognizably distinct from *axillaris*, to which the males bear the greatest resemblance. It seems, therefore, that a subspecies may be distinguished in this general region to which the name *lafresnayana* may be applied. The salient characteristic of the females is the rather uniform clear ochraceous color of the under parts, distinctly deeper, in most cases, than in *axillaris* and including the throat and sides of the head which are whitish in *axillaris*. Crissum usually much tawnier. The upper surface tends to average grayer than in *axillaris*, although some skins of the latter form are not distinguishable on that account.

The males are not so easily separable though they appear to average a trifle paler gray and to have the lower belly, crissum, and upper tail-coverts more often blackish than gray. The under tail-coverts, furthermore, are less broadly, though more sharply, tipped with white. Possibly the white tips of the rectrices average narrower than in *axillaris* but, except in extreme examples, the difference is of no service in distinguishing the forms.

An adult male and a very young one from the junction of the Beni and Mamoré appear to be assignable rather to typical *axillaris*, which occurs farther down the Madeira, but without more material it is impossible to say, without question, that this point is outside the range of *lafresnayana*. A single female from Monte Cristo (to the west of the upper Gy-Paraná) is much like *lafresnayana* below though warmer brown above. Other Matto Grosso females are like typical *axillaris*. Males are somewhat intermediate, having the under tail-coverts gray with broad black subterminal bands and white tips, and the general coloration lighter gray than in *axillaris*. Without more material from Matto Grosso it is impossible to fix the ranges in this region with any certainty.

Hellmayr's record of *axillaris* (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 150, 1924) from Yahuarmayo, Río Inambari, Perú, must belong also to *lafresnayana*.

Specimens Examined

M. a. albigula.—PANAMÁ: 18♂, 14♀ (incl. types). NICARAGUA: 1 ♂. COLOMBIA: Cauca Valley and Pacific coast region, 4♂, 4♀. ECUADOR (west); 5♂, 3♀.

M. a. melaena.—COLOMBIA: "Bogotá," 1♂, 1♀[1]; La Morelia, 2♂, 1♀; Floren-

[1]Specimens in Field Museum of Natural History, Chicago.

cia, Caquetá, 3♂, 2♀. VENEZUELA: region of upper Río Orinoco, Mt. Duida and Río Cassiquiare, 53♂, 43♀; Orope, Zulia, 3♂,[1] 1♀.[1] BRAZIL: Rio Negro (Tatú, San Gabriel, Yavanari, Mt. Curycuryari, and Santa Maria), 9♂, 10♀; Rio Uaupés, Tahuapunto, 1♂; Boca Lago, Teffé, 3♂, 4♀. ECUADOR: Zamora, 4♂, 1♀; mouth of Lagarto Cocha, 1♂; mouth of Río Curaray 9♂, 3♀; below San José, 1♂, 2♀; Río Suno, above Avila, 4♂, 4♀; lower Río Suno, 3♂, 3♀. PERÚ: Puerto Indiana, 11♂, 9♀; Moyobamba, 1♂,[1] 1♀[1]; Yurimaguas, 2♀[1]; Rioja, 1♂[1]; Pomará, Río Marañón, 2♂, 3♀; Sarayacu, Río Ucayali, 4♂, 4♀; Orosa, Río Amazonas, 1♂, 1♀.

M. a. heterozyga.—PERÚ: mouth of Río Urubamba, 2♂; Santa Rosa, upper Ucayali, 8♂, 5♀ (incl. type); Puerto Bermúdez, 1♀,[1] 1♀.[1]

M. a. lafresnayana.—BOLIVIA: Mission San Antonio, 3♂, 4♀; mouth of Río San Antonio, 5♂, 1♀; Río Espiritu Santo, 1♂; Santa Cruz, Río Surutú, 1♀; Todos Santos, 5♂, 6♀. PERÚ: Astillero, 1♀.

M. a. axillaris.—FRENCH GUIANA: 6. BRITISH GUIANA: 23♂, 16♀. VENEZUELA: Maripa, 1♂; Suapuré, 2♂, 1♀; La Unión, Caura Valley, 2♂, 4♀; Sacupana, 1♂. BRAZIL: Faro, Rio Jamundá, 15♂, 8♀; Rio Negro (Muirapinima, Igarapé Cacao Pereira, and Manaos), 17♂, 6♀; Rio Tapajoz, 15♂, 6♀; Rio Xingú, 5♂, 1♀; Villa Bella Imperatríz, Rio Amazonas, 6♂, 3♀; Utinga, Pará, 1♂; Rio Madeira, 11♂, 5♀; Tury-assú, Maranhão, 1♂,[1] 2♀[1]; São Antonio, Goyaz, 1♀[1]; Matto Grosso (Utiarity, Rio Roosevelt, and Barão Melgaço), 4♂, 4♀. [?BOLIVIA: falls of the Rio Madeira, 2♂].

Myrmotherula schisticolor interior (Chapman)

Myrmopagis schisticolor interior CHAPMAN, 1914, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 614—Buena Vista, Colombia; ♀; American Mus. Nat. Hist.

In a series from eastern Colombia, eastern Ecuador, and northern Perú, I am unable to detect any recognizable differences. There is much variation in the extent of the black on the lower breast and the tone of gray exhibited by the males, while the females also vary in the tone of ochraceous ventral coloration, but this is shown by birds from the same regions and is not of diagnostic value. The Peruvian males are more frequently inclined to show whitish tips on the black and gray feathers of the lower breast, but the feature is absent as often as it is present. One male from Huarandosa, Río Chinchipe, has a broad, concealed area of white across the breast which obviously is abnormal.

Inadvertently I omitted an account of this species from my report on the birds of the Marshall Field Peruvian Expedition of Field Museum of Natural History (Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, No. 7, 1930). Three males and two females were secured at Huachipa, September 21–28, and compared with a male from Bogotá and a small series of *M. s. schisticolor*. A slight difference was observed between the two females in that one was less purely gray above (more tinged with olivaceous) and paler ochraceous below, exhibiting the same differences

[1]Specimens in Field Museum of Natural History, Chicago.

that are shown in some of the material now before me. According to Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 154, footnote *b*, 1924), females from the Marcapata district of Perú are similarly variable.

In addition to the material recorded below there are records from Huambo, Amable Maria, Paltaypampa, and Huaynapata, Perú.

SPECIMENS EXAMINED

M. s. schisticolor.—PANAMÁ, NICARAGUA, GUATEMALA, and COSTA RICA: 20♂, 17♀. COLOMBIA (Antioquía and Cauca regions): 11♂, 3♀. ECUADOR (west and south to Alamor: 16♂, 8♀.

M. s. sanctae-martae.—COLOMBIA: Santa Marta region, 2♂ (incl. type), 2♀ (incl. type of *Hylophilus brunneus* Allen). VENEZUELA: 6♂, 2♀.

M. s. interior.—COLOMBIA: Buena Vista, 3♂, 3♀ (incl. type); Aguadita, 1♂; La Palma, 1 "♀" [=♂], 1♀; La Candela, 1♂, 1♀; "Bogotá," 1♂.[1] ECUADOR: Lower Sumaco, 4♂, 1♀; Río Oyacachi, 1♂; PERÚ: Lomo Santo, Río Marañón, 2♂, 1♀; Huarandosa, Río Chinchipe, 1♂; Santa Rosa, Río Marañón, 2♂; Chaupe, 5♂; Huachipa, Río Huallaga, 3♂,[1] 2♀.[1]

Myrmotherula longipennis longipennis Pelzeln

Myrmotherula longipennis PELZELN, 1868 (September), 'Orn. Bras.,' p. 153—Rio Negro, Marabitanas (Brazil); ♂, ♀; Vienna Mus.

Two perfectly typical females of the typical subspecies are at hand from Apayacu, Río Amazonas, Perú, and mark the most southeastward extension of range known for this form. Apayacu is a small river which flows into the Amazon from the north between the Napo and the Ampiyacu where Pebas is situated, and is given on some maps as Anayacu. The collecting station appears to have been on an island at the mouth of this stream. Since *longipennis* occurs at this locality there is every reason to suspect that it continues westward to the east bank of the Napo. There are no earlier records of this subspecies from Perú.

Myrmotherula longipennis garbei Ihering

Myrmotherula garbei IHERING, 1905, Rev. Mus. Paulista, VI, p. 441, Pl. xv, fig. 1—Rio Juruá, Brazil; Mus. Paulista.

The material at hand justifies my supposition (Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 330, 1930) that the form of *longipennis* occurring in eastern Perú is *garbei* and not *zimmeri*. The surprising discovery is that this form also crosses the Amazon below Iquitos and occurs on the left bank of the Napo at its mouth, while *zimmeri* seems to be restricted to the region of the Río Suno and the Río Curaray in

[1]Specimens in Field Museum of Natural History, Chicago

Ecuador. The males from the mouth of the Napo are equivocal but a female is unquestionably in closer agreement with birds from the Ucayali, and from Teffé, than with the type and two other females of *zimmeri*.

At the same time I have examined a skin of this species from La Morelia, Colombia, which I am inclined to think is closer to typical *longipennis* than to the east-Ecuadorian race. There are traces of white on the sides of the throat but not pronouncedly on the auriculars, and these seem to be rather the remains of juvenal plumage than the characteristics of adult *zimmeri*. The skin can be matched rather closely with examples of *longipennis* but not with *zimmeri*, though this may be explainable by reason of the much larger series of *longipennis* at hand. Two males and a female are at hand from Rosarinho, on the left bank of the Madeira. The males are equivocal and could be referred to either *garbei* or *ochrogyna*, with perhaps more resemblance to *ochrogyna* in the restricted black area of the throat. The female, however, is a definite *garbei* and shows that the range of this upper Amazonian form extends eastward to the left bank of the Madeira.

Two young males of *garbei* from the Ucayali are exactly like the adult males above; below the throat is grayish white, and the rest of the under parts dull gray, with a few black feathers appearing on the lower throat and upper breast. They are quite unlike young *longipennis* which are brown above, buffy on the breast, more whitish on the throat, and rufescent brown on the wings and tail, and in which the throat becomes almost entirely black before the brown and buff disappear in the rest of the plumage.

Specimens Examined

M. l. longipennis.—Brazil: Tatú, Rio Negro, 7♂, 3♀; Mt. Curycuryari, Rio Negro, 4♂, 9♀; Yucabi, 2♂, 4♀; Tabocal, 2♂, 2♀; Tahuapunto, Rio Uaupés, 1♂, 3♀. Venezuela: Mt. Duida, 7♂, 3♀; Río Huaynía, 4♂, 2♀; Río Cassiquiare, Solano, 1♂; La Unión, Caura, 1♂; Suapuré, 1♂, 2♀. British Guiana: Potaro River, 1♂; Potaro Landing, 1♂; Tumatumari, 1♂, 1♀; Minnehaha Creek, 1♂; Arwye Creek, 1♂; Macouria Creek, 1♀. Colombia: ? La Morelia, 1♂.

M. l. zimmeri.—Ecuador: upper Río Suno, 1♂, 1♀ (type); lower Río Suno, 1♂, 1♀; mouth of Curaray, 2♂, 1♀. Perú: Apayacu, Río Amazonas, 2♀.

M. l. garbei.—Perú: Santa Rosa, Río Ucayali, 2♂; mouth of Río Urubamba, 1♂, 1♀; Puerto Bermúdez, 1♂[1]; Puerto Indiana, 2♂, 1♀. Brazil: Santo Isidoro, Teffé, 1♂; Boca Lago, Teffé, 2♀; Caviana, 1♂[2]; Arimã, Rio Purús, 1♂[2]; Hyutanahan, Rio Purús, 1♂[2]; São Paulo de Olivença, 2♂[2]; Rosarinho, Rio Madeira (left bank), 2♂, 1♀.

[1]Specimen in Field Museum of Natural History, Chicago.
[2]Specimens in Carnegie Museum, Pittsburgh.

M. l. ochrogyna.—BRAZIL: Limõal, Rio Tapajoz, 2♂; Villa Bella Imperatríz, Lago Andirá, 2♂, 3♀; Serra de Parintins, 1♂, 1♀; Igarapé Auará, Rio Madeira (right bank), 2♂, 4♀; Borba, 1♀.

M. l. transitiva.—BRAZIL: Barão Melgaço, 1♂; Rio Teodoro, 1♂, 1♀.

M. l. paraensis.—BRAZIL: Utinga, near Pará, 1♂, 1♀; Victoria, Rio Xingú, 1♂; Santa Elena, Rio Jamauchim, 1♀.

Myrmotherula minor subspecies ?

An immature male bird from Sarayacu, Río Ucayali, presents a curious problem which I am unable to solve at the present writing. In general aspect it might be taken for a young *M. menetriesii menetriesii*, which occurs on the Ucayali, but in certain particulars it bears a greater resemblance to *M. sunensis* and *M. minor*. It is slightly paler above than either *sunensis* or *minor* but darker than *m. menetriesii*. The under parts show mixed juvenal and adult plumage. The throat is buff; the upper breast has the feathers black nearly to their bases but rather broadly tipped with buff; some of these feathers still in the sheath have the tips gray. The sides are dull brownish buff with some juvenal feathers rather brighter. The lower breast is buff with gray bases. The flanks are gray, faintly buffy as in half-grown *m. menetriesii;* the middle of the belly is orange ochraceous, being replaced by pale gray; the lower flanks are browner. The under tail-coverts are brownish buff. The under wing-coverts are dull whitish. The upper wing-coverts are dull gray tipped with clay color but new feathers are black with white tips, in place only among the lesser series. The remiges are blackish, margined externally with the gray of the back except on the two outermost which are edged with ochraceous. Tail dark gray with an ill-defined blackish area terminally or subterminally and fine whitish tips on the two outer pairs. The bill is quite small as in *sunensis* and *minor* and much smaller in every way than in *m. menetriesii;* it is deep black in color. The sides of the head are dull whitish or buffy white including the prominent shafts of the auriculars, but the tips of the auriculars are dusky gray. Wing, 51.5 mm.; tail, 25.5; culmen from base, 15; exposed culmen, 11; tarsus, 15.

A female from the Río Suno, above Avila, Ecuador, may belong with this male. It is grayish brown above, rather lighter than females of *sunensis*, and with the forehead grayish but not at all ochraceous. Sides of the head as in the Sarayacu male but with tips of auriculars more olivaceous brown than gray. Throat white in a distinct patch, with fine dusky terminal fringes, not at all conspicuous. Breast dull pale buff; sides and flanks browner, much darker posteriorly. Under tail-coverts

brownish buff. Under wing-coverts whitish, slightly buffy. Upper wing-coverts inconspicuously margined with dull rufescent brown. Wings and tail dusky, margined with the color of the back. Wing, 54 mm.; tail. 29; culmen from base, 14.5; exposed culmen, 11; tarsus, 16.5. In the white throat and other characters, this bird answers closely to the description of female *minor*, though I have none of that sex for comparison. Compared with *sunensis* females, this specimen is paler above and decidedly paler below but so near in size and apparent affinities that I am unwilling to separate it from *sunensis* which occurs at the same locality. If it is an example of aberrant *sunensis* it points to a decidedly close relationship of that form with *minor*.

Although *M. minor* is largely confined to the states of Rio de Janeiro and São Paulo in southeastern Brazil, Madam Snethlage has recorded it once from the Rio Purús. I must refer my Sarayacu bird to the same species, though I judge it to represent an undescribed subspecies which I am unwilling to name without more nearly adult material. Probably *minor*, *sunensis*, and this western Amazonian form will be found to form a specific group by themselves.

Specimens Examined

M. minor.—Brazil: Meatuba, São Paulo, 1 ♂.

M. minor subspecies.—Perú: Sarayacu, 1 ♂.

M. sunensis.—Ecuador: Río Suno, above Avila, 2 ♂, 1 ♀; lower Río Suno, 2 ♂, 2 ♀ (incl. type); below San José, 1 ♂; mouth of Río Curaray, 2 ♂, 2 ♀.

Myrmotherula menetriesii pallida Berlepsch and Hartert

Myrmotherula cinereiventris pallida Berlepsch and Hartert, 1902, Novit. Zool., IX, p. 74, part—Nericagua, Venezuela.

The only Peruvian skins of this subspecies at hand are from near the mouth of the Napo. They agree with others of a long series from southeastern Venezuela, the Rio Negro, Brazil, eastern Colombia, and eastern Ecuador. The form ranges westward along the north bank of the Marañón through Pebas, Iquitos, and the Río Tigre and, according to Hellmayr, crosses the Marañón to its south bank, west of the junction of the Huallaga; records are from Chyavetas and Yurimaguas. A similar distribution is shown by certain other members of the family such as *Schistocichla leucostigma subplumbea*, previously discussed (Amer. Mus. Novit., No. 500, p. 18, 1931). East of the Huallaga, *pallida* is replaced by typical *menetriesii*, treated below.

Berlepsch and Hartert, in the original description of this subspecies, included birds from Suapuré and Caura River (Venezuela) in this form

as distinct from the Guianan *M. m. cinereiventris*. Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 162, 1924) considered Caura River examples to belong rather with *cinereiventris*. Two adult males, a young male, and an adult female at hand from Suapuré and the Caura and Mato rivers seem rather to confirm the conclusions of Berlepsch and Hartert. The adult males are as dark as *cinereiventris* but can be matched exactly in some of the series of *pallida* from the Rio Negro, Brazil, while the adult female and the young male (which may be a young female) are very decidedly unlike the series of *cinereiventris* and like *pallida*. Probably the region is on the boundary between the ranges of the two forms where both styles of coloration can be found.

Myrmotherula menetriesii menetriesii (D'Orbigny)

Myrmothera Menetriesii D'Orbigny, 1838, 'Voy. Amér. Mérid.,' Oiseaux, p. 184—east of Cochabamba in territory of Yuracares Indians; ♂; Paris Mus.

I can find no differences between birds from eastern and southeastern Perú, south of the Amazon, and those from Bolivia. According to Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 164, 1924) this form ranges west to the Huallaga (Chamicuros) beyond which the east-Ecuadorian *pallida* is found. The range thus embraces the humid Tropical Zone of Perú from the east bank of the Huallaga through the Ucayali and Javari drainages and on the upper western affluents of the Madeira in Bolivia and southeastern Perú (Yahuarmayo). Probably the range extends down the left bank of the Madeira to its mouth, though I have seen no specimens from the Amazon east of Teffé.

A single female from the neighborhood of Borba, on the right bank of the lower Madeira, ought to belong to *omissa* which Todd described from both banks of the Tapajoz, but it is not typical of that form and shows more resemblance to *pallida* than to any other subspecies. Without more material from this region it is unsafe to assign this specimen to one form or the other. Hellmayr's *berlepschi* seems to be restricted to the right bank of the upper Madeira and the adjacent portions of Matto Grosso.

In Perú, *menetriesii* is found most commonly in the lower portion of the Tropical Zone, though the records from Amable Maria and Monterico would indicate an occasional ascent to higher elevations within the zone.

Specimens Examined

M. m. menetriesii.—Bolivia: Todos Santos, 3♂; Mission San Antonio, Río Chimoré, 4♂, 1♀. Perú: Montealegre, Río Pachitea, 1♂; mouth of Río Urubamba, 5♂, 2♀; Santa Rosa, Ucayali, 10♂, 7♀; Lagarto, Ucayali, 1♂, 2♀; Sarayacu, 2♂, 5♀. Brazil: Boca Lago, Teffé, 1♂, 1♀.

M. m. pallida.—VENEZUELA: Nericagua, 1 ♂, 1 ♀; Orinoco R., foot of Mt. Duida, 7 ♂, 11 ♀; Caño León, 10 ♂, 5 ♀; Río Pescada, 1 ♂, 1 ♀; "Campamento del Medio," Mt. Duida, 1 ♂; Savana Grande, 1 ♂, 1 ♀; Lalaja, 1 ♂, 1 ♀; Esmeralda, 4 ♂, 5 ♀; Playa del Río Base, 12 ♂, 10 ♀; Caño Seco, 1 ♂, 2 ♀; Valle de los Monos, 4 ♂, 1 ♀; Río Cassiquiare, El Merey, 5 ♂, 4 ♀; opposite El Merey, 2 ♂, 2 ♀; Río Orinoco, mouth of Río Ocamo, 2 ♂, 6 ♀; opposite mouth of Río Ocamo, 4 ♂, 1 ♀; confluence of Río Huaynía and Río Cassiquiare, 4 ♂, 4 ♀; La Unión, Caura R., 1 ♂; Suapuré, 1 ♂; Mato R., 1 ♂, 1 ♀. BRAZIL: Rio Negro, Tatú, 8 ♂, 6 ♀; Tabocal, 5 ♂, 5 ♀; Yucabi, 1 ♂, 1 ♀; Yavanari, 1 ♀; Mt. Curycuryari, 5 ♂, 1 ♀; Muirapinima, 2 ♂; São Gabriel, 2 ♂, 1 ♀; Rio Uaupés, Tahuapunto, 3 ♂, 6 ♀; Iauarate, 1 ♀. COLOMBIA: La Morelia, 1 ♂, 1 ♀; Río Uaupés, opposite Tahuapunto, Brazil, 1 ♂. ECUADOR: below San José, 3 ♂; lower Río Suno, 3 ♂, 2 ♀; Río Suno, above Avila, 3 ♂, 5 ♀; mouth of Río Curaray, 5 ♂; Río Napo, 1 ♂; mouth of Lagarto Cocha, 1 ♂. PERÚ: Apayacu, 1 ♂, 1 ♀; Puerto Indiana, 2 ♂, 2 ♀.

M. m. cinereiventris.—FRENCH GUIANA: Tamanoir, 2 ♂, 1 ♀. BRITISH GUIANA: Minnehaha Creek, 1 ♂; Tumatumari, 2 ♂, 1 ♀; Potaro Landing, 1 ♀. BRAZIL: Faro, Rio Jamundá, 2 ♂, 5 ♀.

M. m. omissa.—BRAZIL: Rio Tapajoz, Tauarý, 1 ♂, 4 ♀; Rio Madeira, Igarapé Auará (near Borba), 1 ♀.

M. m. berlepschi.—BRAZIL: Rio Roosevelt, 1 ♂, 1 ♀; Barão Melgaço, 1 "♂" [= ♀].

Myrmotherula assimilis Pelzeln

Myrmotherula assimilis PELZELN, 1868 (Sept.), 'Orn. Bras.,' II, p. 152—Amajau (? = Rio Anajahú, part of delta of the Rio Branco), Brazil; Vienna Mus.

A male and two females from Puerto Indiana compare very well with forty-six additional skins from the Rio Negro, Rio Jamundá, Rio Madeira, and Teffé, Brazil. Possibly the male and four females from Teffé are faintly darker than those from more eastern localities, but the difference hardly justifies a name for the western birds.

The only additional records from Perú are those of four males and one female from Nauta, listed by Hellmayr (Novit. Zool., XIV, p. 384, 1907). The range in Perú, as known at present, thus appears to be restricted to the north bank of the Amazon.

SPECIMENS EXAMINED

M. assimilis.—BRAZIL: Igarapé Cacao Pereira, Rio Negro, 1 ♂, 1 ♀; Muiripinima, Rio Negro, 4 ♂, 3 ♀, 1 (?); Faro, 3 ♂, 2 ♀; Rosarinho, Rio Madeira, 8 ♂, 1 ♀; Santo Antonio de Guajará, Rio Madeira, 1 ♂; Borba, 2 ♂, 1 ♀, 1 (?); Igarapé Auará (near Borba), 2 ♂, 3 ♀; Villa Bella Imperatríz, 4 ♂, 2 ♀; Teffé, 4 ♂, 2 ♀. PERÚ: Puerto Indiana, 1 ♂, 2 ♀.

AMERICAN MUSEUM NOVITATES

Number 525 | Published by The American Museum of Natural History New York City | May 21, 1932

55 1, 79 (79 8)

SOME FROZEN DEPOSITS IN THE GOLDFIELDS OF INTERIOR ALASKA

A STUDY OF THE PLEISTOCENE DEPOSITS OF ALASKA

By Albert S. Wilkerson[1]

ABSTRACT

A description of the frozen deposits in the vicinity of Fairbanks, Alaska, is given. The deposits consist of muck, sand, gravel, peat, volcanic ash and pure ice. The materials, other than the ash and ice, are shown to be of slope-wash and fluviatile origin. A large percentage of the ice is of glacial origin. The volcanic ash is the first to have been found in the region, and its probable source is discussed. The deposits contain large quantities of bones of Pleistocene vertebrates.

INTRODUCTION

During the spring of 1929, an agreement was made between Mr. Childs Frick of The American Museum of Natural History and President Bunnell of the Alaska Agricultural College and School of Mines to place a party in the field during the summer months to collect vertebrate fossils in the vicinity of Fairbanks, Alaska. During the seasons of 1929 and 1930, the field work was in charge of Mr. Peter Kaisen, who has been for many years a member of the American Museum's department of vertebrate palæontology. The writer was in charge of the field work during the 1931 season.

Vast gold-placer deposits are being worked in the vicinity of Fairbanks by the Fairbanks Exploration Company, a subsidiary of the U. S. Smelting, Refining, and Mining Company. Huge dredges are maintained at Goldstream, Wagner, Gilmore, Cleary and Chatanika mining camps situated on the Steese Highway nine to thirty miles northeast of the town of Fairbanks. The collecting of fossils during the three seasons and the geologic work of the 1931 season were carried on at these mining camps. Geologic work was carried on also at Fox, a Company holding between Goldstream and Wagner, and at Fairbanks Creek, a few miles southeast of Cleary.

Placer mining in interior Alaska involves problems not encountered in most places. The difficulties arise because there is usually a thick

[1]Professor of Geology at Alaska Agricultural College and School of Mines, Fairbanks (College P. O.), Alaska.

overburden of frozen muck upon the frozen gold-bearing gravels. The frozen muck overburden is hydraulicked off—in the camps mentioned, by water brought 90 miles in a huge ditch. The frozen gold-bearing gravels are then thawed so that the dredges can dig into them. The thawing of the gravels is accomplished by what is known as the 'Cold Water Thawing Method.' Ditch water and natural drainage water are forced through vertical pipes, of ¾ inch diameter, which are driven to bedrock. These pipes are placed at 16 feet to 32 feet centers.

Besides collecting numerous vertebrate remains found in the frozen muck overburden, the writer had the opportunity of studying the peculiar frozen deposits as they daily were being hydraulicked. This article presents a description of these frozen deposits and attempts to explain their origin.

ACKNOWLEDGMENTS

The writer acknowledges, with much appreciation, the assistance of President Bunnell and Mr. Childs Frick, and the courtesies afforded by the Fairbanks Exploration Company. The officers and employees of the latter, a subsidiary of the U. S. Smelting, Refining, and Mining Company, facilitated in many ways the collecting of fossil remains uncovered by their dredges and the study of the stratification of the deposits on their properties. Information relative to similar deposits was received from Mr. E. Austin, manager of the Fairbanks Gold Dredging Company. Data received from Dean E. N. Patty, dean of the Alaska College, and from Mr. Paul Hopkins, associate chemist with the U. S. Bureau of Mines, are acknowledged. Last, but not least, the writer acknowledges the helpful suggestions from his assistant, Mr. Wilson W. Walton, graduate student in the Alaska College.

DESCRIPTION OF DEPOSITS

General Considerations

Frozen deposits are found in numerous valleys in interior and northern Alaska. In the Fairbanks district, frozen deposits are quite noteworthy because they contain gold and cover many of the gold-placers. Very little work of a geologic nature has been done on the frozen deposits in the vicinity of Fairbanks, and it has seemed strange to the writer that this should be so, because the deposits are different and, therefore, all the more interesting.

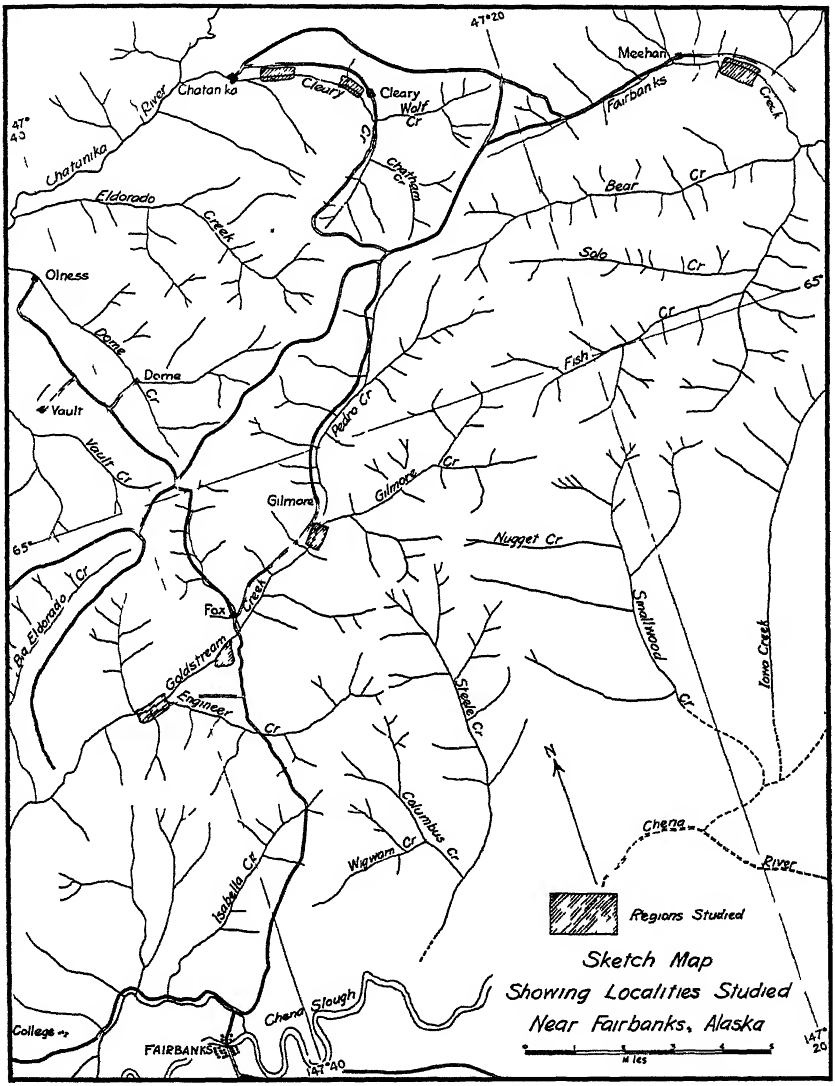


Fig. 1. Sketch map of frozen Pleistocene deposits to the northeast of Fairbanks, Alaska. The deposits consist of fossiliferous gold-bearing gravels, sand, peat, muck and masses of ice.

The frozen deposits consist of muck, gravels, sands, peat and other vegetation, volcanic ash and ice. The muck is prolific in fossil remains, containing especially super-bison, mammoth, horse, occasional moose, caribou and carnivores and numerous rodents of Pleistocene age[1]. The term muck usually is applied to the frozen muds, but it is sometimes used locally to designate any or all parts of the frozen materials over the gold-gravels. In this paper, the term muck is used in the first sense.

Except for thickness, the gold-bearing gravels and their overburden of ice and frozen muck, gravels, sands, peat and volcanic ash are more or less alike. A generalized description of one placer camp in the Fairbanks region would do for most of the others. A detailed vertical section from one locality, however, cannot be duplicated at any other place. In general, the deposits have the following sequence: bedrock usually of Birch Creek schist of pre-Cambrian age; on this are the frozen gold-gravels; then frozen muck containing beds of gravel, sand, peat and ash. Interspersed throughout the deposits are beds, irregular masses and 'dikes' of ice. In some localities there are beds of ice of considerable thickness and of great areal extent lying beneath a large percentage of the muck. The materials above the gold-gravels, taken as a whole, are stratified, though poorly so. The muck itself, for the most part, is unstratified. The various beds have various attitudes ranging from horizontal to vertical. Areally, the deposits change suddenly, the muck giving way to any of the phases mentioned. Few of the beds have any great areal extent.

Gold Gravels

The gravels underlying the muck are generally separated from it rather sharply, though at places there seems to be a gradation of the two. The gravels vary in thickness from a few feet to over a hundred feet, an average thickness being about 30 feet. The gravels are not exceedingly coarse, there being little material greater than 15 inches in diameter. The gravels are composed of the bedrock of the region—mica schists, quartz-mica schists, quartzite schists, garnetiferous schists, vein quartz, and other phases of the Birch Creek schist. Bones, skulls, teeth and tusks of Pleistocene vertebrates are also found in the gravels.[2] Nearly all of the gravel is in somewhat flattened, subangular pieces, and is not excessively water-worn. Fine materials in the gravels are composed of

[1]Frick, C., 1930, Natural History, XXX, No 1.

[2]Practically all the fossil specimens from these gravels were recovered by the men on the dredges. The bones came from all parts of the gravels, as nearly as can be told No special type of animal is found alone in these gravels—all the various specimens collected were represented in these gold-bearing gravels.

Fig. 2 Superbison skeleton, approximately one-twentieth natural size. Assembled from bones of different individuals found scattered in the frozen muck deposits of the Fairbanks area.

the same materials as the coarse, with the addition of some of the weathered products of the schists. The gold, except for a few colors, is found close to, or on, bedrock. The gravels are usually tightly frozen.

Muck

The term muck here applies to the fine mud materials, usually tightly frozen, which normally overlie the frozen gold-gravels. Except for being frozen, the muck is unconsolidated. The muck is mostly unstratified. It varies greatly in thickness, being over 100 feet at Fairbanks Creek, over 70 feet at Chatanika, and about 30 feet at Goldstream. At any one camp the thickness varies greatly. It is always thicker on the slip-off slope[1] of the valley than it is on the other side. The muck deposits are always steeper on the slip-off side of a valley than on the "undercut" side of a valley—see cross-section. The "slip-off" side varies from place to place—on one limb of a valley we have a slip-off portion, then an undercut portion, then another slip-off portion. The muck extends up the hillsides, in some instances as much as 200 feet to 300 feet above the valley floor. On such hillsides the muck gradually thins out and becomes mixed with the coarser disintegration products.

The muck always contains a large percentage of muscovite mica. A mineral analysis shows the muck to consist of the resistant minerals of the bedrock schists. A few boulders 3 feet in diameter are found in the muck, but where coarse materials are found they seldom are greater than 2 inches in diameter.

Some vegetable matter is found throughout the muck. Peter Kaisen reports the occurrence at variable depths in the muck of layers of green moss, the moss going to pieces on thawing. The decay of this vegetable matter and dried flesh on the bones of some of the animal remains give the muck a putrid stench that at times is quite nauseating.[2]

The muck varies in color according to its moisture and vegetable content, being darker in color when the moisture and vegetable content are large. The prevalent color of the muck is dark gray to black, but it

[1]Under certain conditions that are well known, a river not only cuts downward but cuts in a lateral direction against its banks. Moreover, this side-cutting is greatest against those sides of the curves which front up against the course of the river. These sides tend to be undercut. The opposite side of the banks (opposite to those undercut) descend to the river with more or less gentle and gradual slopes. These gradual slopes are called "slip-off" slopes since the stream tries to slip away from them without eroding—in a large number of cases depositing materials because of a slack in the stream's velocity.

[2]I believe that the decided stench of the muck is due to both decaying flesh and to decaying vegetation. To what degree the stench is due to the air reacting on the flesh is uncertain. I found several bones with flesh adhering to them, the exact number I cannot recall. These specimens are in the collection sent to the Museum. I see no reason to believe that these bones are of more recent date than any of the other bones—every find of such bones was such as to indicate that the bones are of the same age.

is also found as light gray, tan and brown. The colors usually blend and give a mottled effect.

Beds, 'dikes' and irregularly shaped masses of ice are found interspersed throughout the muck. The intimate association of the muck and ice will be discussed later. Distributed as thin layers throughout the muck are beds of sand and gravel and peat. Many of these beds within the muck lie horizontally; others dip at low angles in the direction of the present stream drainage; others dip more steeply from the sides of the valleys toward the centers of the valleys; others are vertical or nearly so. In some localities the muck is as much as 30 feet thick

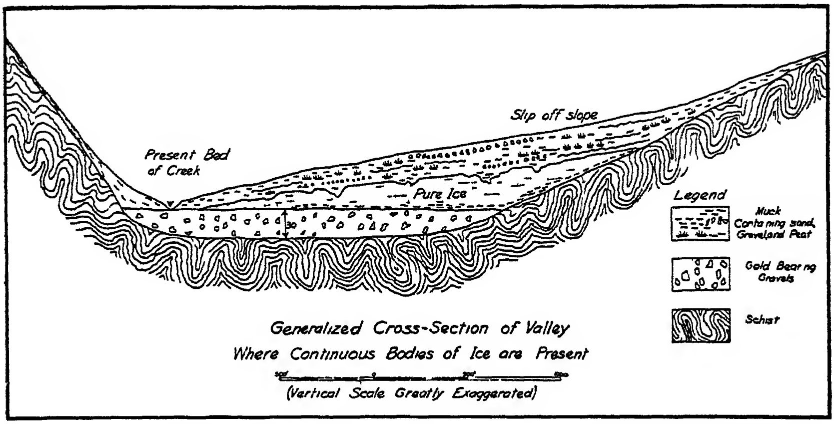


Fig. 3. Generalized cross-section of the Pleistocene deposits where continuous bodies of ice are present.

without having a bed of sand or other material contained in it, while at still other places not far distant there are ten or more beds of gravel or sand or peat within the muck in a vertical distance of a few feet. Here and there are found small forests which had been covered and thus preserved. The trees have a maximum diameter of 28 inches, the average diameter being 6 to 8 inches. Numerous stumps and roots of such trees are to be seen covering thousands of square feet.[1] Muck is found both beneath and above such occurrences. At some places within the muck, and on gravel beds within the muck, are found branches and logs disposed in haphazard manner, the long dimensions of such vegetation usually being horizontal.

[1]Prof. Gasser, professor of agriculture at the College, states that the trees "to all appearances" are spruce, the exact kind not being known to him. Prof. Gasser saw a few specimens which I collected several years ago. I am not acquainted with any occurrence of rerooted tree stumps. I saw none that I recognized as such.

Ice

Five per cent. is an estimated percentage of ice in the overburden. This percentage does not include the extremely large amount of frozen moisture in the muck which acts as a binding material. At some localities, as at Lower Fox and Upper Cleary, ice makes up as much as 60 to 65 per cent. of large areas. In some localities, as parts of Fairbanks Creek, ice is practically missing.

The ice varies in thickness from a fraction of an inch, as found in some beds, to over 30 feet.

The ice assumes various shapes—is found in beds, 'dikes' and irregular masses. The lower portions of a large percentage of the masses of the ice are connected.

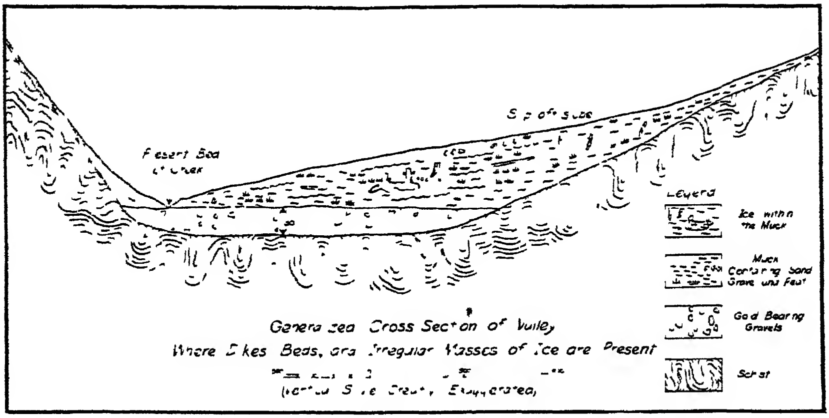


Fig. 4. Generalized cross-section of the Pleistocene deposits where dikes, beds and irregular masses of ice are present.

Generally the ice is very clear, but sometimes it contains small amounts of muck, giving it a dull appearance. Sometimes pebbles of bedrock are visible in the ice. The ice usually has very distinct crystals that have an average diameter of about ⅛ inch. The ice generally contains air bubbles up to an estimated amount of 5 per cent. of the ice. These air bubbles usually occur haphazardly, but at times are found in vertical rows, in horizontal rows, or in rows that are inclined in various directions and at various degrees of inclination. One large piece of ice may show two or more types of rows of air bubbles. Some of the bubbles are seen to be flattened at any angle inclined to the horizontal. The vertical rows do not necessarily contain the vertically flattened bubbles nor the horizontal rows the horizontally flattened bubbles.

Beds, 'dikes' and irregularly shaped masses of ice are common at most of the camps. The beds range from a fraction of an inch in thickness to over a foot. The width of the beds of ice is generally but a few feet, sometimes but a few inches. 'Dikes' of ice vary from a few inches to ten or more feet in height, and from a fraction of an inch to two or three feet in width. The sides and upper and lower surfaces of these 'dikes' may be straight and smooth, or irregular. Almost without exception, irregularly shaped masses of ice are thicker at the top than at their lower portions. The top surface of the ice, as well as the sides of the

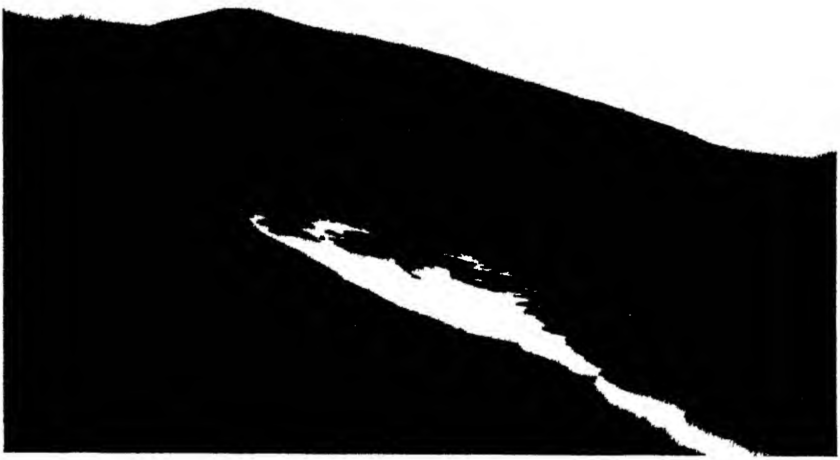


Fig. 5. Tongues of rock waste and vegetative cover creeping to lower levels. (Snapshot taken at 11:00 P.M. in June.)

block, are smooth in some cases and quite irregular in other instances. Beds and masses of ice are found separating the various phases of the deposits or may be contained in any one phase. 'Dikes' of ice are found in all phases of the deposits or may be cut through all of them.

A large percentage of the ice is seen to be continuous. This fact is not readily observed at most places and can be seen only by studying the deposits day by day as the hydraulicking advances. At Fox and Upper Cleary, however, the continuity of the ice can be seen at a glance, as at these places the hydraulicking has gone on in such a manner as to

expose the ice and muck in deep cuts. In many localities, the muck, as it washes over the ice, obscures the ice and leaves the impression that little or no ice exists. Portions of Goldstream, Chatanika and Lower Cleary, as well as Fox and Upper Cleary, show large percentages of the ice to be continuous. At Gilmore, Wagner and Fairbanks Creek, existing conditions are such that continuity of the ice could not be determined.

At places where the ice is continuous, the ice sometimes rests on frozen gold-gravels and at other times upon a comparatively thin layer of frozen muck. The contour of the lower surface of the ice approxi-

Fig. 6. Part of a glacier with overburden of frozen muck and peat.

mates the contour of that portion of the valley in which it happens to lie. The upper surface of the ice always slopes from the slip-off or more gentle side of the valley toward the center of the valley, the sloping surface varying from 3 to 15 degrees. Portions of the upper surface of the ice are extremely smooth, but the major portion is usually uneven, as if a sheet of ice on a sloping surface had undergone much erosion. At no place do any of the irregularities of the upper surface of the ice protrude higher than the smooth, sloping surface of the ice. At Fox the ice is seen to be continuous for at least 1000 feet in width and about the same number of feet in length, and has a maximum thickness of about 35 feet. With further hydraulicking the length and width will, without a doubt, prove to

be very much greater. It is the writer's surmise that the portion seen is but a small fraction of the total amount of continuous ice present. The measurements given for Fox are also quite characteristic of the other camps where such ice is exposed.

Many, but not all, of the irregularly shaped masses and 'dikes' of ice rest on large beds of ice such as noted at Fox and other camps.

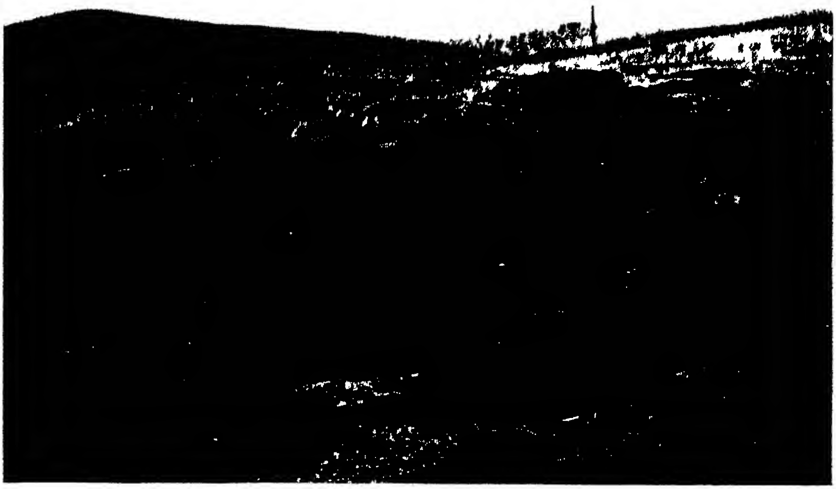


Fig. 7. The frozen deposits exposed by hydraulic 'giants'

Beds, Other Than Ice, Contained in the Muck

Peat

Beds of peat are of very common occurrence wherever muck is found. The beds range from ½ inch to 3 feet in thickness, the average thickness being about 3 inches. In some localities as many as fifteen beds of peat can be seen in a vertical distance of five feet. A large percentage of the peat beds covers but small areas. Most occurrences show the peat to be of relatively pure vegetable matter, but at times it contains small amounts of sand. Practically all of the peat is frozen.

It is the usual thing for muck to underlie and overlie peat beds. At times peat is found to lie directly on ice, and at other times upon gravel or sand beds. At times it underlies gravels, sands, ice, or even volcanic ash.

Peat beds in the overburden have various attitudes, ranging from horizontal to vertical, the horizontal or gently inclined beds predominating

Gravels and Sands

Frozen gravel beds and frozen sand beds occur frequently within the muck. The average thickness of such gravel beds is a few inches, with a maximum thickness of 30 inches. The average diameter of the

Fig. 8. Network of iron pipes through which ditch water is run to thaw the frozen gold-bearing gravels.

gravel is about ½ inch. The gravel is always very angular. The rock composition of the numerous beds is similar to that of the gold-gravels. It is the usual thing for muck to underlie and overlie the gravels. A few beds rest on ice. The position of the beds is similar to that of the beds of peat.

The average thickness of the sand beds within the muck is about 1 inch, with a maximum of about 8 inches. The sand ranges from medium- to very coarse-grained. The sand is composed of the more resistant minerals and rocks in the immediate vicinity. The sand beds usually underlie and overlie muck, but a few beds are seen to rest on ice. The position of the beds is similar to that of peat and gravel within the muck.

Many exposures show sand, gravel and peat beds turned up at their contacts with 'dikes' and irregularly shaped masses of ice. While the muck is largely unstratified, it, too, shows evidence of upturning at many contacts with the ice. For the most part, where any of the beds contact with the large masses of the continuous ice, this upturning is not noted.

Volcanic Ash

To the writer's knowledge, he is the first to discover a deposit of volcanic ash in the vicinity of Fairbanks. The ash is found as a thin whitish layer from 2 feet to 10 feet beneath the surface. It stands out quite

Fig. 9. Beds of muck, gravel, sand and peat are disturbed, when in contact with ice masses.

noticeably against the darker colors of the muck. It varies somewhat in thickness at any one camp, but has an average thickness of 1 inch.

A microscopic study shows the ash to consist practically entirely of glass. The index of refraction of the glass is 1.490, corresponding to an obsidian glass. A few crystals of hornblende and some crystallites are present in the ash.

The volcanic ash is usually found in the muck proper, but at times, as at Chatanika, it rests directly on peat. At no place is it seen to rest on gravel, sand or ice.

The attitude of the ash beds is variable. It generally is horizontal or gently inclined. Where inclined, the usual inclination is toward the center of the valley.

The surfaces on which the gravels, sands, peat and ash were formed are quite undulatory. Uneven contacts are the rule throughout the muck deposits. Uneven contacts are very noticeable at almost any place, but they are especially noticeable when the volcanic ash is present. This is true because the ash stands out in contrast to the rest of the deposits.

Fig. 10. Lower jaw and teeth of a mammoth.

Much of the ash has been displaced since its formation. Step-faulting on a very small scale has occurred. It is one of the outstanding physical features of the ash bed.

A FEW OBSERVATIONS IN THE VICINITY OF FAIRBANKS

THE MANTLE OF TO-DAY

Numerous outcrops of bedrock in the Fairbanks district are to be found, almost entirely, close to or at the summits of the ridges of the highlands and on the steeper slopes of the valleys. The gentle slopes and the valley floors are formed, almost without exception, of unconsolidated materials of varying degrees of coarseness.

There is usually a deep mantle of both residual and transported materials over a very large portion of the district. This unconsolidated material is composed of silts, sands and gravels which have been brought down the slopes of the valleys and have been stratified to some extent by running water. The material also includes much broken bedrock and rock slides.

Slope-waste forms an important percentage of the mantle upon bedrock. It continually slips down the slopes and unites with the materials of stream action. A thick blanket of moss and other vegeta-

Fig. 11. An exposed, frozen nest of a rodent. Ice dike behind nest.

tion usually covers the hills and valley sides. To some extent this vegetative cover keeps the coarser materials from being transported to lower levels, and allows the freezing and thawing to continue for a greater length of time than it normally would do, at any one level; it also allows the coarser materials to be broken into finer and finer particles. Fine-grained materials make up a considerable fraction of the slope-wash.

Tongue-shaped ripples of waste and vegetation, largely moss, are common features throughout parts of the district, especially that part which is above timber line. The ripples are moss-covered—both the waste materials and the moss moving down hill. The lower limits of the

ripples, as they advance down hill, have a very characteristic scalloped outline. It is generally believed that the process of formation of these tongue-shaped ripples of waste and moss has been aided by a decrease of friction, the decrease being due to a frozen surface above which there is saturated waste material, the saturation increasing the mobility.

The main weathering process going on to-day in this region is disintegration. Disintegration, which is almost continuously at work, tends to give us finer and finer particles not unlike the parent substances. These fine substances are moving down the slopes, both steep and gentle. While some coarse material is carried onto the valley floors and some fine products of disintegration are left at the higher levels, it is the general rule that the coarse products are left at the higher elevations and the finer materials are brought to the lower altitudes.

Peat

Just a word need be said about the peat in this vicinity. It is quite well understood that peat is usually a product of a mild or even cold climate. Peat is common in the Fairbanks district. Near College it is 18 feet in thickness. The moss and small vegetation from which the peat formed is believed by the writer not to have grown in water, but to have thrived in damp places which were slightly above the water level, in flat areas where the drainage is sluggish and, perhaps, around the margins of ponds. To-day peat is forming in such places. The writer is not acquainted with any locality in the district where there is a lake or pond containing floating vegetation or a floating fringe of vegetation. Many small ponds are fringed with vegetation, however, which is growing up from the bottom.

Ice

Almost without exception, there is, in interior Alaska, permanently frozen ground at some depth. Above this permanently frozen ground there is everywhere some thickness of material which is alternately frozen and thawed each year. Although dependent to a great degree upon the cold of winter and the warmth of summer, the thickness of this alternately frozen and thawed ground is also dependent upon the nature of the material lying above the frozen ground Clays and like materials thaw much more slowly than sands or gravels. If the surface of the ground is covered by moss, peat or fine-grained disintegration products, the underlying materials will thaw during the summer much less than in regions which are covered with gravels or are not moss-covered. Most

of the regions known to the writer alternately freeze and thaw to a depth of about 4 feet.

The formation of ice over the flood plains of rivers and creeks in interior Alaska is of yearly occurrence. Deposits of ice over flood plains, ice formed in valleys and at valley junctions, ice formed on hillsides—in fact, ice formed directly from flood waters and ice formed on a surface by ground-seepage are called 'glaciers' by the miners and some geologists of the Territory. The term glacier is so used here.

The formation of these glaciers is easily understood. Whenever, during the cold period of the year, the flow of a river is slackened by the formation of ice along the shores, ice forming in shallow places, or the formation of anchor ice, the waters coming from the headwater regions will be impeded and overflow. The overflow water soon freezes and within a short time an icy flood plain exists.

Small creeks build large deposits of ice where they leave gullies and tend to spread out into a valley. The formation of distributaries at the mouth of a gully offers greater surface per volume of water and thus tends to freeze quickly. Water from the head of a gully spreads out over the frozen mass and, in turn, itself freezes, building up a deposit of ice much after the manner of an alluvial fan.

Groundwater seepages along hillsides cause the formation of many glaciers. In most cases the glaciers are built largely during the early part of the winter before the flow of groundwater ceases. Some glaciers, perhaps, are built during the late winter or early spring. Glaciers of hillside origin are known to grow to great dimensions: glaciers about 1000 feet long, 1000 feet wide, and 10 feet to 25 feet thick are not unknown to form in favorable places to-day.

Glaciers forming during the winter are melted during the summer months. The writer has seen some glaciers, however, that have persisted until about the middle of summer. It is a question whether the climate in times past was such that all the ice might have existed without any sort of protective covering. It is not unlikely that this was so, because even to-day there is but little excess of melting over freezing. Ice can exist indefinitely, if there be protective material on it. This protective covering need not be thick, if it is fine-textured. Muck and moss form an almost perfect covering. A covering for the ice might be formed of material transported by gravity, by water, or, to a very small extent, by the wind.

THEORY OF FORMATION

It is the belief of the writer that the muck and the various beds of sand and gravel which it contains are a product of slope-wash and fluviatile conditions.

After the placer-forming period,[1] fine-grained products of long-continued disintegration predominated, and (as the products to-day are descending to lower and lower levels) glided down the slopes of the uplands and tended to fill the valleys. As practically all the valleys were unsymmetrical, the deposits grew more rapidly, and thus thicker, on the slip-off slopes. The slope-wash deposit had an initial dip characteristic of the slope of the surface upon which it happened to lie, the dip invariably being from the uplands toward the lower levels. Some of the products of the slope-wash joined the materials of stream action, giving stratified, more or less horizontal, beds of muck. Some coarse disintegration products were deposited with the fine products, as would be expected.

During wet seasons coarse materials would be a considerable percentage of the wash from the uplands, the gravels and sands being deposited in the valleys by the meandering streams. Many of the beds of sand and gravel have initial slopes dipping away from the uplands; other beds deposited by running water are horizontal. The angularity of the sands and gravels shows that there had been very little transportation of these materials.

The muds of the slope-wash contained, at various places, a considerable amount of small vegetation, the decay of which gives the decided stench to the deposits.

That a great percentage of the deposits, if not the whole amount, was formed slowly and at a comparatively quiescent time, is attested by the fact that there exist numerous thin beds of peat throughout the fine-grained muck. Moss and other small vegetation that grew in the flat areas of the valleys where the drainage was sluggish, and also perhaps around the margins of numerous ponds, were covered time after time by the wash from the hills and by the muds during flood stage of the streams. From time to time sands and gravels were deposited by streams upon the vegetation. Some of the vegetation forming the peat came, without a doubt, from the sides of the hills. Some of this peat forms short vertical dikes within the muck.

Portions of the valleys were forested by small trees, the stumps of many of these trees being covered in situ by muds and sands and gravels

[1]Prindle, L. M., and Katz, F. J., 1913, "A reconnaissance of the Fairbanks Quadrangle, Alaska," U. S. Geol. Survey Bull. 525, pp. 96–98.

of slope-wash and fluviatile origin. Log jams were quite common in the streams. These jams, plus the types of deposits formed, indicate that the streams were perhaps meandering and sluggish.

Different hypotheses have been presented as to the origin of deeply frozen ground in the far north regions. Russell[1] was of the belief that deposition and freezing were more or less simultaneous; Brooks[2] believed the frozen ground to have resulted from a colder Pleistocene climate and that to-day the ground is thawing in places. Some consider that the ground has been frozen under present climatic conditions.

The writer believes that mining operations in the vicinity of Fairbanks testify to the fact that that part of the ground which is frozen during any winter, thaws during the succeeding summer, and that under present climatic conditions it would be impossible for ground to be deeply frozen and remain so.

The writer believes that the gold-gravels and their overburden were frozen but a short time after deposition and that the upper portions were thawed each summer, the depth of thawing never quite equaling the depth of the freezing, so that the thickness of the frozen materials is the result of numerous additions of materials which were frozen shortly after deposition. The thickness of the deposits argues against the freezing having taken place after the whole of the deposits had been formed.

The estimate of the relative age of the pure ice within the muck will be different, according to the manner of the ice formation. Did the ice masses form after the muck and its enclosed beds? Did the ice masses form simultaneously with the muck deposits? Did the ice masses form prior to the muck deposits? Did some of the ice form simultaneously with the muck and some after its formation? A study of the air bubbles is of no help in studying the origin of the ice, as there is no regularity of the bubbles.

That the continuous beds of ice, up to 30 feet and 40 feet in thickness, formed after all the muck and its included beds were laid down, is out of the question. Such formation would have required a vertical pushing up of an average of about 20 feet of muck as the ice grew in thickness. It seems improbable that the continuous ice bodies formed later than the major portion of the muck. Large caves, filled with water which later froze, are not to be considered.

A detailed study of the physical relations of the continuous bodies of ice leads the writer to believe that this ice is of glacial origin, the glaciers

---

[1]Russell, I. C., 1889, "Surface Geology of Alaska," Bull. Geol Soc. America, I, pp. 129–130
[2]Brooks, A. H., 1916, "Antimony deposits of Alaska," U. S. Geol. Survey Bull. 649, p. 27.

forming along hillsides as the groundwater escaped, building up glaciers which extended across the valleys. The ice was preserved by a protective mantle of muck, gravel, sand and peat brought down upon it by spring freshets and by slope-wash. Successive deposits of muck and carpets of arctic vegetation gradually spread over the original protective mantle and thus insured the ice permanent protection.

Small streams eroded much of the glacial ice and deposited thereon sands and gravels and muck. Some of the muck, gravel, sand, logs and isolated boulders within the ice are explained as successive outwash upon the growing glacier.

The numerous disconnected and variously shaped blocks of ice found within the muck were formed after much of the muck, and thus the glaciers, were formed. Various narrow 'dikes' of ice cutting across numerous peat beds show that the ice must have formed in cracks within the deposits, because the ice could not have stood up in the air during the length of time it took for the enclosing materials, including the peat, to form.

It is believed that the disjoined and variously shaped masses of ice were formed in cracks in the muck. The cracks, usually parallel to the length of the valley, were due to the slippage of masses of the muck to lower and lower levels. Many times the slippage of the muck occurred on the upper surface of the continuous beds of ice. Some of the cracks were formed by the freezing and thawing of the deposits, combined with the pull of gravity. Water drained into the cracks and gradually froze against the cold sides. With very cold weather the ice contracted, and in consequence a new crack was formed between the ice and the walls or within the ice itself. Water filling this crack and again contracting with very cold weather allowed the fissures to grow in width. Where an original crack started there would be a zone of weakness, and the fissure likewise continued to grow to higher elevations as subsequent materials were added from time to time. Since fissures formed in said manner taper downward, the ice masses are thinner at the bottom and wider at the top. The growth of the masses of ice went on from year to year, possibly failing during some mild winters when most of the cracks were open.

Due to the freezing of the water against the walls of the fissure and due to the expansion of the ice during the summer, the readjustment of the stresses caused strain in the immediate vicinity of the ice masses. The strained beds of muck, gravel, sand and peat were forced upward, toward the region of least resistance, at the contacts, and at times were pushed vertical or even beyond.

The presence of thawed ground at various localities appears to be the result of present-day circulation of underground water. Water at any temperature above the freezing point causes the ice and frozen muck to thaw and melt.

It is believed that the climatic conditions at the time of formation of the deposits were not essentially different from to-day.

The volcanic ash, found in the vicinity of Fairbanks, had its origin, perhaps, in some crater near the northern border of the St. Elias Mountains near the international boundary. The thickness of the ash, the fact that it occurs in only one stratum, the physical characteristics of the ash, and its depth beneath the surface lead one to believe that it is the same ash that Capps describes as being present over an area of more than 100,000 square miles in the vicinity of southwest Yukon Territory. Capps[1] reports: "It has long been known that a large area in Alaska and Yukon Territory is covered by a layer of volcanic ash. The ash lies near the surface, beneath a thin covering of soil and silt, and gives evidence of an explosive volcanic eruption that in terms of geologic history is very recent, though antedating historic record in this part of the world." He describes it as a "fine, white sandy material, with a harsh feeling when rubbed between the fingers. Microscopically it is found to consist chiefly of volcanic glass. In addition to the glass, fragments of sanidine feldspar occur, together with portions of minute crystals of hornblende and other minerals." . . . "The outermost observations (of the ash) recorded include, on the west, observations on the Nebesna, Tanana, and Yukon rivers, by Brooks and others; on the northeast and east, on Gravel, Macmillan, and Pelly rivers, by Keele, Dawson, and McConnell; on the southeast, on Teslin River and at Lake Marsh and Lake Bennett, by Schwatka, Dawson and others; and on the south and southwest, along the southeast flank of the St. Elias Range, by Hayes, Brooks, and Capps." The thickness of the deposits varies greatly according to the distance from its origin—at Carcross 1 inch, Eagle ¾ inch, Selkirk 8–12 inches, east of Kennecott and north of Mt. Logan from 2 to 300 feet. Capps goes on to say that "the ash usually appears along cut banks of the rivers as a thin white band near the top of the bank, covered only by a few inches or a foot or two of soil, silt, or vegetable humus." . . . "Over any given district of small area the ash tends to be rather uniform in thickness, although locally it thickens into lenses or thins out entirely. It occurs prevailingly in a single layer, was apparently ejected during one period of eruption, and fell as one con-

[1]Capps, Stephen R., 1915, "An Ancient Volcanic Eruption in the Upper Yukon Basin." U. S. Geol. Survey Prof. Paper 95d, pp. 59–64.

tinuous shower in which there were no time breaks of sufficient length to interrupt the vertical continuity of the deposit." . . . "All the evidence, so far obtained, . . . , both as to the areal distribution of the ash and as to its thickness, points to some crater near the northern border of the St. Elias Mountains near the international boundary as to the vent from which the ash came."

If the ash found in the Fairbanks district is the same as that reported by Capps, and there is every reason to believe that it is, the outer known limit of ash-fall, as given by Capps[1] must be extended westward about 150 miles.[2]

The muck and all, or practically all, of the ice are of Pleistocene to Recent age. Within the muck and its enclosed beds, as previously noted, are to be found remains of the superbison, muskox, moose, elk, caribou, horse, mammoth, lion, bear, wolf and various rodents. During the summer of 1931, the writer collected about two tons of bones which were sent to the American Museum of Natural History. Dried flesh adhered to a small percentage of the bones. In one instance a frozen fossil rodent's nest was found containing the greater portion of a mummified ground squirrel. The largest percentage of the collected bones were obtained from 'bone pits' in several widely separated localities. The Fairbanks region to-day is the one region in the world where deeply buried bones of Pleistocene animals may be recovered without the collector himself having to dig them out, as the thick overburden is being removed for him by hydraulic 'giants' in their search for the underlying gold.

[1]*Loc. cit.*, p. 10, fig. 23.

[2]Similarly, if the Fairbanks ash layer and that studied by Capps (1915, p. 64) have the same origin, and provided Capps' estimate is approximately correct, the average of 3 feet of muck found above the ash in the Fairbanks region was formed during the last 1,400 years; and if the rate of deposition was fairly constant for the muck before and after the eruption, 1,800 to 1,900 years is an estimated age of the deposits, allowing 40 feet of muck as an average thickness below the ash layer.

AMERICAN MUSEUM NOVITATES

Number 526

Published by
THE AMERICAN MUSEUM OF NATURAL HISTORY
New York City

59. 57, 7 (7)

NEW NORTH AMERICAN DIPTERA, WITH NOTES ON OTHERS

BY C. H. CURRAN

The flies described in the following pages have mostly been received for identification during the past year. Since the description of the snowberry fruit fly, *Rhagoletis symphoricarpi*, I have received many queries concerning the correct name for the blueberry maggot, an insect also closely related to the apple maggot, and I now present the results of studies of these related forms.

The types of the new species are in the Museum collection and I wish to express the thanks of the Museum for these donations and also my appreciation to those who have furnished the interesting material upon which this paper is based.

STRATIOMYIDÆ

RHINGIOPSIS Röder

The following key separates the known species.

TABLE OF SPECIES

1.—First antennal segment but little longer than the second .... 2.
First antennal segment at least twice as long as the second .... 3.
2.—Abdomen black, with two subtriangular pale spots on either side; the lateral margins of the fifth segment reddish .... *rostrata* Wiedemann.
Abdomen yellowish, a broad median vitta and the fourth segment, black; fifth segment yellowish .... *tau* Röder.
3.—Scutellum greenish yellow, the sides and spines black; mesonotum with a pair of triangular yellow vittæ behind the suture .... *bequaerti*, n. sp.
Scutellum with the middle, sides and spines yellow; mesonotum without yellow vittæ .... *nasuta* Enderlein.

Rhingiopsis bequaerti, new species

Black and rusty yellow with greenish tinge; first antennal segment three times as long as the second; wings brown on apical half except posteriorly. Length, 16 mm.

FEMALE.—Head rusty yellowish, with greenish tinge below; front shining black, with a large, oval yellow spot on either side lying mostly below the middle. Face most prominent at the upper fourth, the "snout" cut off squarely at the end, black on the upper surface. Front of moderate width, the upper fourth strongly produced upward. Posterior orbits wide, acutely margined above; occiput black in the middle

and emitting a black stripe to the vertex. Proboscis black, the small palpi brown. Antennæ black, the first segment three times as long as the second, the third a little more than twice as long as the first two combined.

Mesonotum shining black, the lateral margins very broadly yellowish, broadly interrupted behind the suture but broadly produced inwardly in front; behind the inner ends of the suture with an elongate, subtriangular yellow vitta. Pleura greenish yellow or yellowish green, the pectus black, emitting a very broad black stripe half-way to the mesonotum behind the front coxæ and a narrow one above the posterior coxæ. Metapleura mostly blackish. Scutellum rusty yellowish, with green tinge apically, the sides very broadly, and the spines, black. Hair very short, black, longer on the upper part of the pleura, yellowish on the pectus.

Legs black, black-haired; first tarsal segment reddish brown.

Wings brown on the apical half, in front of the fourth posterior cell, the basal cells tinged with brown and the strong veins distinctly bordered with this color. Squamæ brown, brown pilose above. Halteres brown on the basal half, bright green apically.

Abdomen shining black, the lateral margins very broadly rusty reddish-yellow, greenish on the first segment and apical half of the fifth. Venter black, the sides very broadly yellowish. Hair very short, black, yellow on the pale portions.

TYPE.—Female, Chichen Itza, Yucatan, Mexico, June, 1929 (J. Bequaert).

TRYPANEIDÆ

ALEOMYIA Phillips

PHILLIPS, 1923, Journ. N. Y. Ent. Soc., XXXI, p. 123.

Only one species was originally included in this genus, but it is very evident that *Rhagoletis caurina* Doane and a new form from Arizona belong here. The three species are separable as follows.

TABLE OF SPECIES

1.—Brown fascia extending from the apex of the second vein over the posterior cross-vein interrupted..2.
This fascia entire..*rufipes*, n. sp.
2.—Brown fascia across the middle of the wing interrupted (Oregon)..*caurina* Doane.
Brown fascia across the middle of the wing not interrupted (Maryland). *alpha* Phillips.

Aleomyia rufipes, new species

Figure 1

Reddish yellow, the abdomen entirely, the thorax partly black. Length, 2.5 mm.

FEMALE.—Head reddish yellow, the upper three-fifths of the occiput blackish. Front, from dorsal view, almost half as wide as the whole head, slightly longer than wide; three pairs of frontals, the upper pair reclinate; ocellars of moderate length; posterior cilia black; cheeks shining, bare. Proboscis elongate and geniculate, yellowish; palpi slender, yellow and with pale yellow hair. Antennæ yellow, the arista mostly brown.

Thorax reddish yellow, shining, the pleura posteriorly and the metanotum black. Mesonotum with a pair of wide, united median black vittæ on the anterior two-thirds,

a broad sublateral vitta on either side broadly united with the median pair in front of the scutellum and extending from inside the humeri to cover the base of the scutellum at the sides, and an indistinct blackish stripe above the roots of the wings. The black parts on the anterior two-thirds are covered with cinereous pollen. Hair and bristles black. Scutellum bright reddish-yellow with the basal corners black; with four bristles.

Legs wholly reddish yellow, the posterior four coxæ more or less brownish; hair short, pale, the bristles on the anterior femora brown.

Wings hyaline, with whitish tinge and marked with five brown fasciæ as shown in figure 1. Squamæ and halteres yellow.

Abdomen shining brownish black, the first segment of the ovipositor almost as long as the preceding abdominal segments combined. Hair black, the bristles very weak.

TYPE.—Female, Coyote Mts., Arizona, August 4–7, 1916 (F. E. Lutz).

NEASPILOTA Osten Sacken

As no complete key to the Nearctic forms has been published, and as I have before me examples of all the species, I present a key for their separation. *N. brunneostigmata* Doane, published without locality record, probably came from California. The Museum possesses a specimen from Arizona, which agrees with Doane's description, but the species appears to be doubtfully distinct from *albidipennis* Loew.

TABLE OF SPECIES

1.—Stigma unicolorous or practically so, yellowish or pale brownish............2.
Stigmal cell strongly bicolored, brown basally, pale on apical half............4.
2.—Stigma browish or brownish yellow....................................3.
Stigma very pale yellowish, almost uncolored.....................*alba* Loew.
3.—Third antennal segment more than twice as long as wide..*albidipennis* Loew.
Third antennal segment less than twice as long as wide..*brunneostigmata* Doane.
4.—Cross-veins not bordered with brown...................*signifera* Coquillett.
Cross-veins strongly bordered with brown and the wings otherwise marked with this color........... ....*achilleæ* Johnson.

RHAGOLETIS Loew

In his revision of the genus *Rhagoletis* Loew, Cresson[1] places *zephyria* Snow and *symphoricarpi* Curran as synonyms of *pomonella* Walsh. Both species bear superficial resemblance to *pomonella* but, as I have already pointed out,[2] they are distinct and may be recognized on either biological reactions or adult characters. At the time I published my results of the examination of the type of *zephyria* and described *symphoricarpi* I examined only part of the male genitalia and feel sure that the most striking differences were overlooked. Unfortunately, my

[1]Trans. Amer. Ent. Soc., LV, pp. 401–414.
[2]Can. Ent., LVI, pp. 62–63.

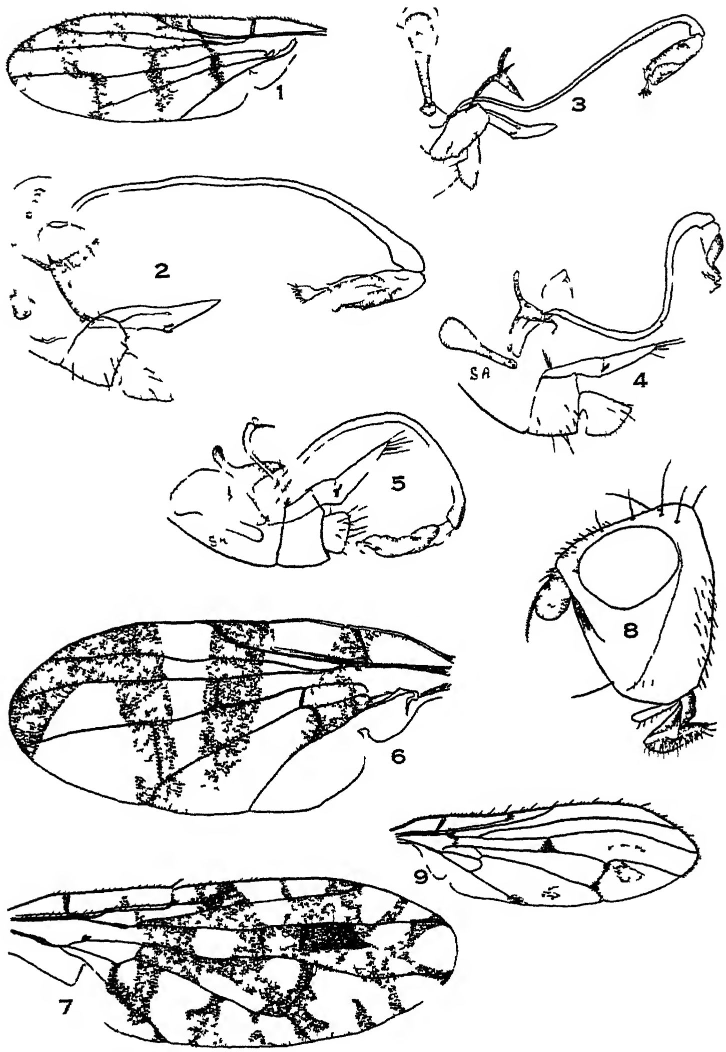


Fig. 1. *Aleomyia rufipes*, n. sp. Wing.
Fig. 2. *Rhagoletis pomonella* Walsh. Lateral view of male genitalia.
Fig. 3. *Rhagoletis mendax*, n. sp. Lateral view of male genitalia.
Fig. 4. *Rhagoletis cingulata* Loew. Lateral view of male genitalia.
S A, sustentacular apodeme
Fig. 5. *Rhagoletis indifferens*, n. sp. Lateral view of male genitalia.
Fig. 6. *Rhagoletis berberis*, n. sp. Wing.
Fig. 7. *Euaresta jonesi*, n. sp. Wing.
Fig. 8. *Anorostoma cinereum*, n. sp. Head.
Fig. 9. *Anorostoma cinereum*, n. sp. Wing.

material of *symphoricarpi* now consists of a paratype of each sex and I do not feel justified in destroying the abdomen of the male in order to prepare a slide for examination.

The question of biological races is a puzzling one but may be said to be comparable to the puzzle provided by species that are superficially very similar in markings and structure. It is almost impossible to decide the specific status of adult specimens, and by the same token it is almost impossible to limit the term "biological race." As our knowledge of insects increases it becomes obvious that specific limits are not to be decided by a mere superficial examination of a dried insect, but that a knowledge of the habits as well is of importance. The knowledge that certain insects have different habits or hosts should lead to a detailed examination of the adults to discover, if possible, any constant differences that may be correlated with the unusual habit. In the case of the examination of the four species of *Rhagoletis* discussed below, the habits of each of the two related species are distinct. The species feeding on wild cherry, and closely related to *R. cingulata,* will not oviposit on cultivated cherries and, inversely, the so-called cherry fruit-fly will not oviposit on wild cherries. The same is true of the blueberry and apple-feeding species.

In interpreting the illustrations of the genitalia, too much stress must not be placed upon the detailed structure of the penes, since a very slight turn of these organs results in a different appearance and the length or shape of the "tube" is of no importance. Since the specimens from which the illustrations were made are mounted on slides it was impossible to secure the same view for each specimen. In the sustentacular apodeme is to be found ready means of determining the species, as this organ exhibits striking differences in shape in the various forms studied. The slides are preserved in the Museum collection.

In order to facilitate the identification of the species I have prepared a key to the Nearctic forms. The species described as *caurina* by Doane belongs to the genus *Aleomyia* Phillips.

Table of Species

1.—Wings with a continuous hyaline fascia extending from the costa to the posterior border and passing between the anterior and posterior cross-veins......2.
Wings without such fascia.......................................12.

2.—Brown fasciæ on the basal half of the wing not connected posteriorly... ....3.
Brown fasciæ on basal half of the wing broadly connected posteriorly.
tabellaria Fitch.

3.—A short brown band extends from the costa to the third vein between the second and third nearly complete fasciæ.................................4.

No such narrow brown band between the usual broad fasciæ..... ....5.

4.—Broad costal fascia on apex of the wing united with the third fascia in its full width or nearly so (Europe). . ...*cerasi* Linnæus.

The apical costal fascia is narrow and broadly separated from the third transverse fascia (California).. .... *formosa* Coquillett.[1]

5.—A brown fascia extends over the basal and part of the anal cells..............6.

Basal fascia absent...................................*juglandis* Cresson.

6.—Third vein with an isolated elongate brown spot behind the costal brown band. *boycei* Cresson.

Third vein without such spot..... ....7.

7.—Two brown bands beyond the third transverse fascia (or the costal band very deeply indented in the apical cell)..................................8.

Costal band never divided longitudinally for part of its length..............10.

8.—The third transverse fascia and the two brown apical bands form an F-like marking; no hyaline spots along the costa at the apex of the second vein. *striatella* Wulp.

The apical costal band is divided by a deep indentation in the apical cell and there is a hyaline costal spot on either side of the apex of the second vein..9.

9.—Sustentacular apodeme extremely wide, more than half as wide as long (figure 5). *indifferens*, n. sp.

Sustentacular apodeme less than half as wide as long (figure 4)..*cingulata* Loew.

10.—Costal brown band separated from the costa on most of its length. *ribicola* Doane.

Costal brown band not separated from the costa........ ....11.

11.—Mesonotum wholly black in ground color..... ....*berberis*, n. sp.

Mesonotum mostly rusty yellowish in ground color....... *completa* Cresson.

12.—Marginal cell hyaline immediately beyond the first vein.. .. .. 13.

Marginal cell brown except the apex................. . ...14.

13.—Apical fourth of the wing with two brown bands..... ..*fausta* Osten Sacken.

Apical fourth of the wing with only the costal brown band. .. .*sauvis* Loew.

14.—The pale orbital band of the front extends as far inside the frontal bristles as the distance from the bases of the bristles to the orbits........*zephyria* Snow.

The pale orbital stripe extends only slightly inside the frontal bristles at the middle of the front. .. ..15.

15.—Anterior femora wholly brown posteriorly and on the basal half anteriorly, never reddish on their whole length......... ......*symphoricarpi* Curran.

Anterior femora reddish yellow on their whole length at least on the ventral surface... . ...16.

16.—Anterior femora all reddish yellow, with slight brownish tinge posteriorly; sustentacular apodeme of male very obtuse apically, almost transverse. *mendax*, n. sp.

Anterior femora largely brown posteriorly and sometimes in front on the basal half; sustentacular apodeme rather acute apically.....*pomonella* Walsh.

[1]Cresson omitted this species. I include it from description only and it may not be a *Rhagoletis*.

Rhagoletis pomonella Walsh

Figure 2

Trypeta pomonella WALSH, 1868, 'Rep. Nox. Ins. Ill.,' I, p. 29 (f).

Rhagoletis pomonella CURRAN, 1924, Ann. Rept. Ent. Soc. Ont., LIV, p. 57 (f). CRESSON, 1929, Trans. Ent. Soc. Amer., LV, p 409 (f).

As I have already pointed out above, the synonymy given by Cresson is erroneous and *zephyria* and *symphoricarpi* are distinct species. In discussing the synonymy of *zephyria*, Cresson followed Doane, who saw the types but apparently was misled by Snow's statement that the three types were males. The type that I examined was a female and was labelled by Snow. I have no doubt that both sexes possess the differences I pointed out for the female, but since I had no male before me I naturally did not mention that sex.

R. symphoricarpi may be recognized by the decidedly smaller pale spot on the scutellum. Figures of part of the genitalia of this species and *pomonella* will be found in the Curran reference cited above, while the complete genitalia of *pomonella* is figured at the present time. It will be noted that the sustentacular apodeme is acutely rounded apically and the same is true of the crescentric rings on the darkened portion. The appendage at the end of the penis is large and densely haired and is usually readily discernible in dried specimens.

Rhagoletis mendax, new species

Figure 3

Similar to *pomonella* but separable by the shape of the male genitalia. The sustentacular apodeme is more strongly widened apically and is very obtuse on the end, almost transverse. The same is true of the crescentric rings on the darkened portion and it is usually from this part that the shape is to be determined, since the colorless outer portion is not easily seen unless the lighting is excellent.

TYPES.—Holotype and allotype, male and female, Maine (A. D. Pickett); paratypes, male and female, Maine, and two males and three females, Aylesford, Nova Scotia (A. D. Pickett), all reared from *Vaccinium;* male and female, Lakehurst, N. J., July 1 (L. B. Woodruff).

This is the "blueberry maggot," the so-called apple maggot of blueberries, and many references to *pomonella* refer to this species. The wing and body markings are the same as found in *pomonella* but the hair on the front is finer and less conspicuous and the pale scutellar spot is usually smaller in the female.

Rhagoletis cingulata Loew

Figure 4

Trypeta cingulata LOEW, 1862, 'Mon. N. Amer. Dipt.,' I, p. 76 (f). CRESSON, 1929, Trans. Amer. Ent. Soc., LV, p. 408 (f).

In Cresson's figure of the wing the basal brown fascia has been omitted and this figure shows a marked difference from that of Loew. In all my specimens the extent of the hyaline spots extending along the costa on either side of the apex of the second vein is less than shown by Cresson, but in Loew's figure the hyaline area in the submarginal cell is much larger and is actually joined to the hyaline triangle, which extends into this cell from the apex of the apical cell, leaving the anterior portion of the fascia in the form of a roundish spot. There is a possibility that the "cherry fruit-fly" is not *R. cingulata*, but an examination of the type of *cingulata* and a study of the male genitalia will be necessary in order to determine this.

Rhagoletis indifferens, new species

Figure 5

Related to *cingulata* Loew from which it differs in characters of the male genitalia. While the genitalia show several differences, as may be determined by a comparison of the figures, the most obvious is to be found in the remarkably wide sustentacular apodeme in *indifferens* and this species is recognizable on this character alone.

TYPES.—Holotype, male, and allotype, female, Hood River, Oregon, August 17, 1931. Paratypes: seven males and three females, Hood River, June 12, 23, 1931; six males and two females, Corvallis, Oregon, July 15, 19 and August 14, 17, 1931; and two males and one female, Hood River, Oregon, June, 1931 (S. C. Jones). All reared from *Prunus marginata* Douglas.

I am unable to compare this species critically with *cingulata* as all my specimens of the latter are in alcohol. Mr. Jones has informed me that he has failed to induce this form to oviposit on cultivated cherries and that even though it is common on wild cherries adjacent to orchards there is no infestation of the cultivated varieties, nor have attempts to induce *cingulata* to oviposit in wild cherries proved successful.

Rhagoletis berberis, new species

Figure 6

Evidently related to *indifferens*, new species, but without the hyaline area in the apex of the apical cell. Differs from *completa* Cresson in being black in general color, in having a wider hyaline fascia across the middle of the wing, etc. Length, 3.25 to 4.25 mm.

FEMALE.—Head yellowish, frontal vitta reddish or pale orange; occiput black, with the posterior orbits and vertex reddish or yellowish; the head sometimes reddish with the face and frontal orbits yellow and the anterior half of the frontal vitta blackish or dark brown. Five pairs of frontals, the upper two pairs reclinate; frontal hair yellow, practically wanting on the frontal vitta. Occiput very thinly, the face more obviously whitish pollinose. Proboscis and palpi pale orange, the latter with black bristly hairs apically. Cheeks with short black hairs and a black bristle posteriorly, the posterior orbits with yellow hair. Antennæ reddish, the arista mostly brown.

Thorax black, with a broad whitish vitta extending over the humeri and along the upper border of the pleura to the squamæ. Mesonotum with brownish or yellowish-gray pollen on the disc, which leaves the very broad posterior and lateral margins and three rather narrow vittæ shining black. Hair and bristles black, the hair on the mesonotum yellow. Scutellum with four bristles, the apical pair situated within the yellow spot; basal two-fifths of the scutellum black, the apical portion yellow except on the sides; no hair.

Coxæ and femora black or dark brown, the trochanters, apices of the femora, tibiæ and tarsi reddish yellow, the posterior tibiæ brown except on the broad base and apex.

Wings hyaline and brown as shown in figure 6. Squamæ white. Halteres pale yellow.

Abdomen shining blackish, the apices of the second to fourth segments broadly pale in ground color and thickly cinereous-yellow pollinose. Seventh segment (first genital) not or only slightly longer than wide, usually appearing quite short. Hair and bristles black, yellowish on the first and second segments except the sides of the second.

TYPES.—Holotype, female, and four paratypes, females, from *Berberis nervosa* at Hood River, Oregon, June 23, 1931; allotype, male, and ten male paratypes, from *B. nervosa*, Hood River, July 30, 1930, reared by S. C. Jones.

Euaresta jonesi, new species

Figure 7

Differs from *bella* Loew in having a very large hyaline spot in front of the anterior cross-vein. Related to *bellula* Snow but differing in having much larger hyaline spots in the discal cell and usually a hyaline spot at the basal fifth of the apical cell, larger clear spot in front of the anterior cross-vein, etc. Length, 3.5 to 3.75 mm.

FEMALE.—Head yellow, the face paler, posterior orbits, face, cheeks, and narrow frontal orbits with very pale yellowish, the occiput with dull yellow pollen; hair and bristles whitish, the three or four pairs of frontals and the vertical bristles brown. Antennæ pale yellow, the arista brown with yellow base. Proboscis and palpi yellow.

Thorax black in ground color, cinereous pollinose, the squamose hair yellow, the bristles brownish or brownish yellow. Scutellum with four bristles.

Legs reddish yellow, with yellowish hair and bristles; coxæ black in ground color, cinereous pollinose.

Wings (figure 7) dark brown and hyaline, the size of the hyaline spots somewhat variable. There are sometimes two hyaline spots in the stigmal cell; the hyaline spot in front of the anterior cross-vein is always large and always extends broadly to third vein; the basal of the two brown rays lying entirely within the second posterior cell is very often united with the brown of the apical cell, leaving two hyaline areas and there may be three large hyaline spots in the discal cell or the two apical spots may be united; the basal spot in the apical cell may be absent. Squamæ white. Halteres pale yellow.

Abdomen shining black, with the second to fourth segments shining reddish. Hair yellow on the basal half and sides, black on the apical half except laterally. Ovipositor very long.

TYPES.—Holotype and five paratypes, all females, Delake, Oregon, June 6, 1931 (S. C. Jones), from *Gaertneria* species.

In comparison with specimens of *bellula* Snow from California the wings of *jonesi* are much more extensively light-colored and the bristles of the head and thorax are darker in color.

Anorostoma Loew

The following key will serve to distinguish the described Nearctic species.

Table of Species[1]

1.—Sternopleura with three or four strong bristles..................... .....2.
Sternopleura with only one or two strong bristles ....3.
2.—Front deep orange; abdomen reddish yellow............. ...*alternans* Garrett.
Front brownish; abdomen black in ground color, the genitalia reddish. *grande* Darlington.
3.—Sternopleura with two strong bristles......... ....*opacum* Coquillett.
Sternopleura with only one strong bristle..... ....4.
4.—Mesopleura with a broad brown stripe above.... ....*hinei* Garrett.
Mesopleura without such stripe. ....5.
5.—Wings without gray blotches, the end of the auxiliary vein and the cross-veins with brown spots................................*marginatum* Loew.
Wings with gray blotches in addition to the clouded cross-veins..............6.
6.—Hairs and bristles of the mesonotum arising from brown spots. *maculatum* Darlington.
Hairs not arising from dark spots ....*cinereum*, n. sp.

Anorostoma cinereum, new species

Figures 8 and 9

Related to *maculatum* Darlington but readily distinguished by the absence of brown spots at the bases of the mesonotal hairs. Length, 5 to 6 mm.

Male.—Head thickly whitish pollinose; face, cheeks and lowest three-fifths of the occiput reddish yellow in ground color, the upper part of the occiput and the vertex black, the front reddish. Front half as wide as the total head-width when viewed from above, narrowing anteriorly; two pairs of short frontals, the anterior half of the front with short, coarse, sparse black hairs; ocellars long; verticals and outer verticals strong; occipital hairs black; cheeks with only a few hairs below, much wider than the transversely oval eyes. Proboscis blackish; palpi yellow, with a few black hairs. Antennæ black, the first segment brownish red; arista yellowish basally. Vibrissæ weak.

Thorax black in ground color, densely cinereous-white pollinose; mesonotum with an obscure brownish-yellow vitta on either side along the lines of the dorsocentrals and fainter vittæ outside these, the upper part of the mesopleura pale yellowish; the dorsocentral bristles arise from tiny brown spots. The short hair is black and is limited to the mesonotum and sternopleura. The mesopleura bears one bristle, and sometimes a weak hair, behind, while the sternopleura bears only one strong

[1] *A. jersei* and *coloradensis* Garrett are not included but trace to *marginatum* Loew.

bristle. The scutellum is bare except for the four marginal bristles, and the propleural is weak.

Legs with the anterior coxæ, the trochanters, tibiæ, and tarsi reddish yellow, the femora black with pale apices, the whole more or less thickly cinereous-white pollinose. Tarsi with strong apical bristles below; pulvilli cinereous yellow.

Wings with yellowish tinge, in some views appearing white, the veins yellow except apically. There are blackish-brown spots on the apex of the auxiliary vein and on the cross-veins, and gray patches as shown in figure 9, these patches apparently being due to the color of the villous wing covering. Squamæ cinereous yellow, the halteres yellow.

Abdomen black in ground color, densely cinereous-white pollinose, the hairs and weak bristles black. Genital organs reddish, the basal genital segments both dark in ground color.

FEMALE.—Frontal bristles stronger; a small brownish spot inside the basal scutellar hairs; middle femora wholly reddish yellow; apical genital segment with numerous spines.

TYPES.—Holotype, male, allotype, female, and seven males and five female paratypes, Fogerty Creek, Oregon, October 11, 1931 (S. C. Jones), on sea-rocket and sand; six males and five females, Boiler Bay, Oregon, May 18, 1930 (J. Wilcox).

Erycia Desvoidy

The key that follows includes Nearctic species described since the publication of the key in the Canadian Entomologist, LIX, p. 15, 1927, but omits *exilis* Coquillett, since that species belongs to the genus *Dexodes*.

TABLE OF SPECIES

1.—Middle tibiæ with at most one strong and one quite weak anterodorsal bristle. . 2.
 Middle tibiæ with two or three strong anterodorsals . . . . 6.
2.—Dorsocentrals 3–4 . . . . 3.
 Dorsocentrals 3–3 . . . . *seticauda* Reinhard.[1]
3.—First two antennal segments and base of the third reddish; front light-golden pollinose; outer forceps of male strongly widened near the middle. *arator* Aldrich.
 Antennæ usually wholly black, if the second segment is reddish the front is usually cinereous, the scutellum broadly yellow apically and the apices of the abdominal segments very narrowly dark . . . . 4.
4.—Five frontals below the upper base of the antennæ . . . . *tuxedo* Curran.
 Three frontals below the upper base of the antennæ . . . . 5.
5.—Front dull golden pollinose; basal antennal segments rarely reddish; outer forceps of male not constricted basally . . . . *celer* Coquillett.
 Front cinereous pollinose; second antennal segment partly reddish; outer forceps of male strongly widened on the apical half . . . . . . *delecta* Curran.
6.—Three sternopleurals . . . . 9.
 Four sternopleurals . . . . 7.

[1]If there are infrasquamal setulæ this species falls into *Lydella*, otherwise it would appear to belong in *Erycia*.

7.—Apical scutellars suberect; scutellum normally wholly black; apices of abdominal segments broadly shining black.. . ..... *myoidæa* Desvoidy.
Apical scutellars horizontal; scutellum largely reddish....................8.
8.—Male outer forceps less than one-half longer than wide; apices of abdominal segments rather broadly shining, very thinly brown pollinose (Europe). *fatua* Meigen.
Male outer forceps twice as long as wide; abdominal segments pollinose to the apices which are, however, brownish (Europe)........*ferruginea* Meigen.
9.—Second segment without strong discals, sometimes with stout, bristly hairs..10.
Second segment with at least a pair of strong discals (sometimes irregular in female)..... ....12.
10.—Large species, over 9 mm. in length (European)........................11.
Small species, under 8 mm. in length (Texas)............*unispinosa* Reinhard.
11.—Third abdominal segment on either side with an area of appressed, short, fine black hair.......... ....*pratensis* Meigen.
Third segment without such hair; front of male usually with two pairs of orbitals.. *silvatica* Fallen.
12.—Abdomen, from most views, with the apices of the segments broadly shining black..................... ....,...13.
Abdomen yellowish-gray pollinose, the segmental apices only narrowly black; grayish looking species, the fourth segment usually with yellowish tinge..17.
13.—Abdomen wholly shining black (♀)........ .. ..*leechi*, n. sp.
Abdomen conspicuously pollinose..... ....14.
14.—Pollen on the second and third abdominal segments forming a narrow, interrupted basal cross-band (♀).................. ....*deckeri* Curran.
Pollen occupying at least the basal half of the segments................ .15.
15.—Second antennal segment less than half as long as the third...... ....16.
Second antennal segment more than half as long as the third....*leechi*, n. sp.
16.—Not more than the basal half of the abdominal segments whitish pollinose; outer forceps of male genitalia rather narrow; a single pair of discals on intermediate abdominal segments.................. ....*varifrons* Curran.
Usually the basal two-thirds of the abdominal segments pale pollinose; the second and third segments usually with more than one pair of discals; outer forceps of male genitalia narrow basally, broad on apical half. *aldrichi* Curran.
17.—Front in both sexes wider than one eye.....................*rutila* Meigen.
Front in both sexes narrower than one eye.................*celer* Coquillett.

Erycia leechi, new species

Recognizable by the characters given in the key, especially in the case of the female. This is the only species of *Erycia* I have seen in which sexual coloration shows a striking difference. In the males the abdomen is cinereous pollinose with the segmental apices broadly black while the females have the abdomen wholly shining. Length, 5 to 6.5 mm.

MALE.—Head cinereous pollinose, with yellowish tinge, the parafrontals only thinly pollinose on the upper third. Front less than half as wide as greatest width of either eye, strongly widening on the anterior two-thirds; frontal vitta dark brownish-red, with almost parallel sides; ten to fourteen pairs of frontals, the lowest two to

four pairs situated below the base of the antennæ, the upper three or four pairs reclinate; hairs outside the frontals sparse and coarse, a few of those below the frontals directed downward, the lowest frontal opposite the base of the third antennal segment; ocellars long and strong; occipital pile pale yellowish. Cheeks about one-third as wide as the eye-height, the hair coarse. Parafacials decidedly wider than the third antennal segment, very slightly narrowed below. Vibrissæ situated level with the oral margin, the ridges with rather closely placed bristles and hairs on the lowest third. Face rather strongly receding. Antennæ black, the basal segments more or less brownish; third segment not twice as long as the second, rather narrow, rounded at the apex; arista thickened on almost the basal third. Palpi reddish yellow.

Thorax black, rather thinly cinereous white pollinose, the four shining black vittæ conspicuous in some views and rather broad. Acrosticals, 3–3; dorsocentrals 3–4; posterior sublateral very weak or absent; four pairs of marginal scutellars, the apical pair slightly divergent; sternopleurals, 2–1, rarely a second fine one behind.

Legs black; anterior tibiæ with a single posterior bristle; middle tibiæ with three anterodorsal bristles; pulvilli rather short.

Wings cinereous hyaline, rather conspicuously darkened in front. Base of third vein with two or three bristles. Squamæ whitish with yellowish tinge, the lower lobe with brown tinge on the apical two-thirds. Halteres pale yellowish brown.

Abdomen black, cinereous pollinose, a broad median vitta and about the apical fourth of the second and third segments shining. First and second segments each with a pair of median marginals, the third and fourth each with a row; second and third segments each with a pair of discals, the fourth with two rows. Genitalia small.

Female.—Front about half as wide as either eye, gently widening anteriorly, about ten pairs of frontals, the upper two pairs reclinate; two pairs of orbitals; outer verticals about half as long as the verticals; facial ridges less obviously bristled, two or three rather short bristles above the vibrissæ, the face receding. Abdomen shining black.

Types.—Holotype, allotype, and four paratypes, Vernon, British Columbia, July 4, 1929 (H. B. Leech).

The six specimens were reared from *Carabus tædatus* variety, but I am not certain whether they are all from the same adult. However, this species is a parasite of adult beetles and at least four of the specimens are from a single host. Many of the beetle parasites have piercer-like ovipositors but there is no such development in this species.

AMERICAN MUSEUM NOVITATES

Number 527 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | May 23, 1932

56.1 (1181: 78 7)

EOCENE PLANTS FROM WYOMING

BY EDWARD W. BERRY

So far as I know, the only fossil plants recorded from the Wind River or Bridger are those described in 1930 from the so-called Bridger at Crow Heart Butte, Lenore and Tipperary in Fremont County, Wyoming.[1] These were overwhelmingly indicative of Green River age, and the view was expressed that Green River and Bridger were at least partially equivalent.

Since there was some uncertainty as to the so-called Bridger being really Bridger, although this was the opinion of Granger and Sinclair, it is gratifying to see the sort of floras contained in beds definitely referred to the Bridger and to the Wind River, respectively.

I am indebted to Horace Elmer Wood, 2nd, for a small collection from two localities made during the summers of 1928 and 1931. One of these is very limited and comes from the upper part of the lower Bridger on Little Dry Creek. The second and larger collection is from the Lysite about nine miles west of the town of that name and about six miles west of the type locality of the formation on Bridger Creek. The discovery of this locality is due to Mr. O. J. Schofstall. I am further indebted to Doctor Wood for the following notes on this locality:

"This locality is in the northern part of the Wind River Basin, about nine miles west of Lysite, about six miles west of the type locality of the Lysite Formation on Bridger Creek, and considerably farther from fossiliferous exposures of the Lost Cabin Formation on Alkali Creek to the east, or on Muddy Creek, to the west. The plants occur in a massive, bluish shale, and in the underlying paper shale, exposed for about 150 feet on the north side of the Chicago, Burlington and Quincy Railway cut, at the west end of a prominent hill, estimated to rise 125 feet above the tracks, north of Badwater Creek, in Township 38 North, Range 92 West. The west end of the plant-bearing bed is truncated by erosion, and the east end dips underground. The center of the exposure is about 300 feet west of mile-post 293 of the Chicago, Burlington and Quincy Railway. As the Schoening railroad crossing, indicated on the General Land Office Map of Wyoming, 1923, is less

[1]Berry, Edward W., 1930, U. S Geol. Survey Prof. Paper 165 B.

than a mile distant, it would be appropriate to call this the 'Schoening Locality.' (Schoening is misplaced on the map in question, as it is north, not south of Badwater Creek.) It is possible to reach Schoening by driving nine and a half miles west from Lysite, over a rather sketchy trail, walking the remainder of the distance along the tracks; or, the locality could be reached by hand car, from either Bonneville or Lysite, by arrangement with the railroad.

The plants occur, abundantly, in a paper shale, and, overlying it, in a massive, bluish shale, with an apparent dip of 3°–8° east, and an actual northeasterly dip. As the specimens in the paper shale, although exceedingly numerous, were equally fragile, we collected largely in the massive shale above. This latter is overlain by a reddish-weathering, massive shale. Higher up are gray clays, with interfingering white sandstone lenses, ranging up to three or four feet thick. Still higher up the

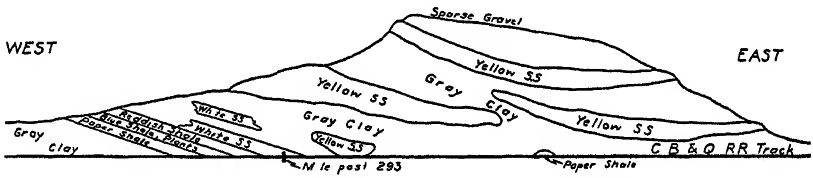


Fig. 1. Diagrammatic view, looking north, of the plant-bearing Lysite, near Schoening.

hill, and to the east, the gray clay contains paper-shale lenses with fragmentary plants, and, also, several thick lenses of cross-bedded yellow sandstone, apparently stream channels, which erode into forms suggestive of the Fox Hills, but which also suggest the sandstone channels in the Lost Cabin Formation on Alkali Creek, seven miles east of the town of Lost Cabin. The top of the hill is covered with a sparse gravel. The only beds visible from the top of the hill are the gray clays, except to the north, where a patch of yellow sandstone appears. This patch, and the hill, are in line with a gap in the Bridger Mountains, not many miles away to the north, and suggest that the sandstones were channel deposits in a stream flowing south from the mountains. The character of the yellow sandstone might suggest that the hill could be an erosion remnant of late Cretaceous rocks buried in Eocene clays. Aside from other considerations, however, this is difficult to reconcile with the fact that the plant bed is both overlain and underlain by gray clays indistin-

guishable from those exposed essentially continuously, between this locality and the type Lysite on Bridger Creek, and that these clays are lithologically similar to the Lysite at the type locality, except for the absence of the red bands, which are well developed on Bridger Creek. These clays, then, can hardly be of other than Lysite age ('Lower Wind River'), except for the possibility of Lost Cabin age (Wind River). The lithology is considerably more suggestive of the Lysite than of the Lost Cabin."

The present collections contain but 11 identifiable species, but obviously a much greater variety would repay careful collecting and it is much to be hoped that these localities will be revisited by someone prepared to make an extensive collection.

The plants identified with their range are shown in the following table:

	Lower Bridger	Lysite	Green River	So-called Bridger of Wind River basin	Puget	Lower Clarno	Claiborne	Jackson
Lygodium kaulfussi	×	×	×	×	×	×	×	
Goniopteris lesquereuxi	×				?	×	?	
Arundo pseudogœpperti		×	×				×	×
Myrica sp.		×	×					
Juglans occidentalis		×	×					
Juglans alkalina (?)		×	×	×				
Quercus castaneopsis		×	×					
Dryophyllum wyomingense		×		×				
Ficus omballi		×	×					
Sapindus obtusifolius		×	×					
Diospyros mira		×		×				

Although the number of species collected is too limited to warrant an extended discussion of either the correlation or ecology, a few remarks are warranted. None of the species is new, although the most abundant form at the Lysite outcrop, *Quercus castaneopsis*, has never before been found except in limited specimens at its type locality in the Green River of Uinta County, and the present material adds considerably to our knowledge of its range in size and form

Of the 11 species recognized, eight are common to the Green River formation, and of these the following five are not known from any other horizons: *Myrica* sp., *Juglans alkalina*, *Quercus castaneopsis*, *Ficus omballi* and *Sapindus obtusifolius*. Of the remainder, *Dryophyllum wyomingense* and *Diospyros mira* are confined to the present collection and to the so-called Bridger farther south where they are associated with a large number of Green River species.

It is clear that the Lysite and the Green River formations are of the same age as the general stratigraphy and vertebrate palæontology would lead us to infer. It is also clear that the type of flora which comes in with the Green River continues for a long time without much change and is rather sharply contrasted with the flora of the Fort Union and what little we know of the flora of the Wasatch. The present collection also adds some support to my formerly expressed opinion that parts of the time represented by Green River and Bridger overlap. It also reinforces the previous plant evidence that, in terms of world chronology, Wind River and Bridger are slightly younger than the vertebrate fossils indicate.

The only plant in the present collection not known from Green River or so-called Bridger is the fern, *Goniopteris lesquereuxi*, and this is identical with or similar to Middle and Upper Eocene occurrences. There can be little doubt that the present flora is of approximately the same age as the Green River flora, that is, middle Eocene, and Lutetian or Auversian in terms of the European section. The precise floral relations between Green River and Bridger must remain undecided until larger collections are available for study. There are several conspicuous elements in both the Green River and the so-called Bridger which are absent in the present collections, notably the several species of palms, the *Aralias, Sparganium,* and *Musophyllum.* Whether these differences are chronological or merely ecological cannot be determined.

As regards environments, the amount of material is so limited that little of value can be stated. Certainly the climate appears to have been warm temperate with a plentiful rainfall. The few species represented

are indicative of a somewhat less humid environment than that shown by the plants from Tipperary, but in such limited material it cannot be certain that this difference is not merely the result of accidents of preservation or discovery.

PTERIDOPHYTA

Family **Schizæaceæ**

Genus Lygodium Swartz

Lygodium kaulfussi Heer

Lygodium kaulfussi Heer, 1861, Beitrage zur nahern Kenntniss der sachsisch-thüringischen Braunkohle, p. 3, Pl. viii, fig. 21; Pl. ix, fig. 1. Lesquereux, 1888, U. S. Nat. Mus. Proc., XI, p. 24. Newberry, 1898, U. S. Geol. Surv. Mon. XXXV, p. 1, Pl. lxii, figs. 1–4. Knowlton, 1899, U. S. Geol. Surv. Mon. XXXII, p. 672, Pl. lxxx, figs. 1–3. 1902, U. S. Geol. Surv. Bull. 204, p. 21. 1923, U. S. Geol. Surv. Prof. Paper 131, p. 149, Pl. xxxvi, fig. 7. Berry, 1926, Geol. Surv. Canada Bull. XLII, p. 95; 1930, U. S. Geol. Surv. Prof. Paper 165, p. 64, Pl. vii, figs. 2, 3.

Lygodium neuropteroides Lesquereux, 1871, U. S. Geol. and Geog. Surv. Terr., Ann. Rept. for 1870, p. 384; 1878, The Tertiary Flora, p. 61, Pl. v, figs. 4–7; Pl. vi, fig. 1.

Twining or climbing ferns that bear sterile pinnules proximad and fertile pinnules with much reduced laminæ in terminal panicles. Indusia attached by their broad bases to short oblique veinlets of the greatly reduced laminæ of the fertile pinnules, imbricated and scalelike exactly as in our existing *Lygodium palmatum* Swartz, the only observable difference being the greater reduction of the laminæ in *Lygodium kaulfussi*. Sterile pinnules variable in size and outline; digitately bipartite, tripartite, quadripartite, or quinquepartite; more or less cordate at the base. Lobes are unequal in length and diverge at different angles, are usually obtusely rounded distad, although some of them taper instead of being linear-oblong, and are somewhat widened at the base and separated by deep, angular or narrowly rounded sinuses. The margins are more or less undulate and in some specimens show very broad and very shallow crenations. Texture coriaceous. Venation clearly defined and strong. Two main primaries diverge from the base and give off subbasally a primary for each lobe, and all become lost in the apex of the lobes by repeated branching. The secondaries are close, diverge at narrow angles, and curve outward. They may be several times narrowly forked, a feature that depends on their position and length, and are thin but sharply defined throughout their whole course, terminating in the margins.

The present species has been recorded from a number of European localities[1] and ranges in age from the Lutetian to the Aquitanian. It was first discovered in America at Barrel Springs, Wyoming, in shales that were long thought to be of Green River age but that are not now considered to be a part of that formation. The exact age is unknown but is probably Middle or Upper Eocene. The species, which is present in great abundance, was originally described by Lesquereux as *Lygodium neuropteroides*. Gardner in his discussion of the ferns of the British Eocene says that Lesquereux had material from Bournemouth and stated in a letter that the American form was "positively identical" with the European, and Newberry came to the same conclusion.[2] Fructifications are associated with these sterile pinnules at several localities. The American material is identical with the European in the character of the fertile pinnules and in the venation of the sterile pinnules. The sterile pinnules are in general broader and more obtuse in the American material. The species is exceedingly abundant in the Eocene of Wyoming. It has also been recorded from the Eocene of the Pacific coast and from the Fort Union of Wyoming, and I fail to find specific differences between these specimens and those from the Claiborne. The species has been found abundantly in the Claiborne, in the so-called Bridger of the Wind River Basin in Wyoming, in the Green River of Colorado and Wyoming, and in the Puget group of Washington and British Columbia.

In the present collections it is represented by considerable material, including both sterile and fertile pinnules from near Lysite and a single specimen of a sterile pinnule from near the top of the lower Bridger at the head of Little Dry Creek.

The genus *Lygodium* has between 20 and 30 existing species in the warmer parts of both hemispheres and extends outside the subtropical zone into the warmer temperate regions in southern Japan (*Lygodium japonicum* Swartz), in northern New Zealand (*Lygodium articulatum* Richard), and in eastern North America, where *Lygodium palmatum* Swartz ranges as far northward as the southern New England States. All the modern forms are lianas, either climbing or twining, and some of the tropical species are said to exceed a hundred feet in length. The Tertiary forms probably shared this habit.

[1]Except for the type reference, only American citations are given in the foregoing synonymy.
[2]Newberry, J. S., 1898, The latter extinct floras of North America: U. S. Geol. Survey Mon. XXXV, p 3.

Family **Polypodiaceæ**

Genus **Goniopteris** Presl

Goniopteris lesquereuxi Berry, new species

Lastrea fischeri Lesquereux, 1883 (not Heer, 1855), Cret. and Tert. Flora, p. 239, Pl. L, figs. 1, 1*a*. Newberry, 1898, U. S. Geol. Surv. Mon. XXXV, p. 10, Pl. XLVIII, fig. 6. Knowlton, 1902, U. S. Geol. Surv. Bull. 204, p. 22. 1914, Bull. 590, p. 36. ?Penhallow, 1902, Roy. Soc. Canada Trans., 2d Ser., VIII, see IV, p. 48. ?Penhallow, 1908, Can. Geol. Surv., Rept. Tert. Plants Brit. Columbia, p. 61.

The geographical remoteness and the great difference in geological age makes it certain that this form from the western United States is not the same botanical species as Heer's type from the Miocene of Switzerland.

It is also easy to point out certain minor differences in shape and venation between the European and American specimens sufficient to justify their recognition as distinct species, but it is a well-known fact to students of recent ferns, although it has not been sufficiently realized by students of fossil ferns, that there can be a great deal of variation in such features within the limits of a single species, so that I rely more on the separation of the two in space and time.

Had it not been for the large amount of material which I have studied of the Claiborne species *Goniopteris claiborniana* Berry[1] and the South American Pliocene species *Goniopteris cochabambensis* Berry[2], from Bolivia and Ecuador, both of which are highly variable, I am sure I would not have fully realized this fact. If these two species and what Lesquereux, Newberry and Knowlton identified as *Lastrea fischeri* Heer[3] occurred in the same section or same basin of deposition, I would refer them, without a moment's hesitation, to a single botanical species. All fall within the same limits of variation in form and degree of incision of the pinnæ and have the same winged stipes.

Goniopteris lesquereuxi is very similar to the more common form of *Goniopteris claiborniana.* It has all the free laterals simple in the limited amount of material which I have seen, but in one fragment from the head of Little Dry Creek, the proximal laterals may send a branch to the adjacent one next above.

There are three specimens in the present collection, most of which are not especially well preserved and evidently considerably macerated before burial, since there is a mass of winged stipes of various sizes and

[1]Berry, E. W., 1917, Torrey Bot. Club Bull., XLIV, p. 331, Pl. XXII. 1924, U. S. Geol. Survey Prof. Paper 92, p. 44, Pls. IV, V.
[2]1922, Johns Hopkins University Studies in Geology, No. 4, p. 159, Pls. I, II. Idem, 1929, No. 10, p. 95, Pl. II, figs. 7–9.
[3]Heer, O., 1855, Flora Tert. Helvetiæ, I, p. 34, Pl. IX, fig. 3.

many fragments of pinnæ, and the other plant remains associated with this species, including *Lygodium*, are also much broken.

Without having seen all the American material which has been referred to *Lastrea fischeri*, it is not possible to make a conclusive statement of distribution.

The material from Currant Creek, Oregon, described by Newberry and referred to by Knowlton, appears to be identical with the present Bridger material, as does also that described by Lesquereux from the John Day Valley in Oregon. These outcrops are referred to the lower Clarno horizon. Penhallow recorded this species from the Paskapoo formation of Red Deer River in Alberta and from the Eocene of Burrard Inlet, British Columbia. Both of these records I regard as highly doubtful, not only because Penhallow's systematic work was notoriously unreliable, but also because he himself points out differences in the case of the Paskapoo material, which was also very limited.

The Burrard Inlet locality belongs to the Puget group which also contains the associated *Lygodium kaulfussi* Heer, and therefore Penhallow's determination may be correct in this case.

A rather full account of the systematic status of the genus *Goniopteris* and of its constituent fossil species was given[1] in 1924, to which the reader is referred.

The present material comes from near the top of the lower Bridger near the head of Little Dry Creek.

SPERMOPHYTA

MONOCOTYLEDONÆ

Order **Poales**

Family **Poaceæ**

Genus **Arundo** of authors

Arundo pseudogœpperti Berry

Arundo gœpperti Lesquereux, 1871, Ann. Rept. U. S. Geol. Surv. Terr., Suppl., p. 5. 1878 (not Munster or Heer), Tertiary Flora, p. 86, Pl. viii, figs. 3–5.

Arundo pseudogœpperti Berry, 1914, U. S. Geol. Surv. Prof. Paper 84, p. 134, Pl. xxiv, fig. 7. 1924, U. S. Geol. Surv. Prof. Paper 92, pp. 49, 148, Pl. xli, fig. 6.

This species is represented near Lysite, and at the other localities from which it has been recorded by fragments of striated stems and parallel-veined leaves, which are rather indefinite as to both specific and generic features. Hence the term *Arundo* is used in a generalized sense and cannot be considered as indicating a close relationship with

[1]Berry, E. W., 1924, U. S. Geol. Survey Prof. Paper 92, pp. 44–46.

existing species of *Arundo*. It was described originally from the Green River and is not uncommon in the Claiborne and Jackson of the southeastern United States

DICOTYLEDONÆ

Order **Myricales**

Family **Myricaceæ**

Genus **Myrica** De Candolle

Myrica sp. Knowlton

Myrica sp. Knowlton, 1923, U. S. Geol. Surv. Prof. Paper 131, pp. 157, 158, Pl. xxxvii, fig. 2; Pl. xl, fig. 13.

Knowlton described two fragmentary specimens from the Green River beds of Colorado as representing two undeterminable species of *Myrica* and pointed out their resemblance to what Lesquereux called *Myrica nigricans*, which last Knowlton referred to the genus *Rhus*, and the writer referred to the genus *Cupanites*. There is this resemblance but there are specific differences.

Although Knowlton's small *Myrica* sp. is not exactly like his larger *Myrica* sp., I believe they belong to a single botanical species, which is probably new but insufficiently represented to be properly characterized. In the present collections from the Lysite there is one small specimen and counterparts of a larger specimen which are the same as Knowlton's Colorado material. These are also too incomplete to be properly described.

Order **Juglandales**

Family **Juglandaceæ**

Genus **Juglans** Linné

Juglans occidentalis Newberry

Juglans occidentalis Newberry, 1883, U. S. Nat. Mus. Proc., V, p. 507. 1898, U. S. Geol. Surv. Mon. XXXV, p. 34, Pl. lxv, fig 1; Pl. lxvi, figs. 2–4. Knowlton, 1923, U. S. Geol. Surv. Prof. Paper 131, p. 158. Berry, 1930, U. S. Geol. Surv. Prof. Paper 156, p. 58, Pl. ix, fig. 4.

This quondam species, which was for a long time confused with *Juglans schimperi* Lesquereux, was described in the first instance from Green River, Wyoming. It occurs also in the Wilcox Eocene and perhaps elsewhere, although this is very uncertain. There is a rather full discussion in Knowlton's paper cited above, which I have followed, although it is highly probable that the two names represent the variants of a single botanical species, in which case the name *schimperi* has priority.

The species is sparingly represented in the recent collection from the Lysite.

Juglans alkalina Lesquereux (?)

Juglans alkalina Lesquereux, 1878, The Tertiary Flora, p. 288, Pl. lxii, figs. 6–9. Knowlton, 1923, U. S. Geol. Surv. Prof. Paper 131, p. 160. Berry, 1930, U. S. Geol. Surv. Prof. Paper 165, p. 68, Pl. x, figs. 1, 2.

This species was heretofore known from only the Green River and the supposed Bridger of the Wind River basin.

There is a considerable number of incomplete specimens, for the most part larger than the type, in the present collections from the Lysite, which I refer to this species with some hesitation. They are referable to the genus *Juglans* with some certainty, and are very similar to this species. They are certainly not distinctive enough to warrant their reference to a new species.

Order **FAGALES**

Family **Fagaceæ**

Genus **QUERCUS** Linné

Quercus castaneopsis Lesquereux

Quercus castaneopsis Lesquereux, 1883, Cret. and Tert. Flora, p. 155, Pl. xxviii, fig. 10.

This species was described by Lesquereux from the Green River beds of Uinta County, Wyoming, and has not heretofore been discovered at any other outcrops. It is the most abundant species in the Lysite at the locality near Lysite, but all of my material is broken. The leaves are of all sizes, but have a characteristic and readily recognizable aspect despite their relative proportions and considerable variability in marginal dentition. The accompanying figure is a composite of proximal medial and distal specimens of a rather large leaf. Some specimens indicate slightly larger leaves than the figure, and from this they range downward to leaves not more than 6 centimeters in length and 1.75 centimeters in maximum width.

The species may be redescribed as follows:

Leaves of variable size, lanceolate in outline, widest below the middle, with an extended acuminate tip and a cuneate base. Margins entire at the base, elsewhere with short, somewhat variably spaced, teeth which range in shape from dentate to serrate; in places these are one to a secondary but they are frequently more numerous. Texture coriaceous. Petiole stout, its length undetermined. Midvein stout and rather prominent. Secondaries stout, numerous and rather closely

spaced, diverging from the midvein at wide angles frequently approaching 90°, subparallel, at first straight but curving regularly and prominently upward in the marginal region, camptodrome; they approach close to the marginal teeth but do not enter them, this being done by tiny oblique tertiaries. There are subsecondaries between many of the secondaries which are lost by branching toward the margins or which may continue to camptodrome endings like the true secondaries. Tertiaries form a series of open inosculating veins at approximately right angles to the secondaries. The areolation consists of very minute but usually prominent polygonal meshes.

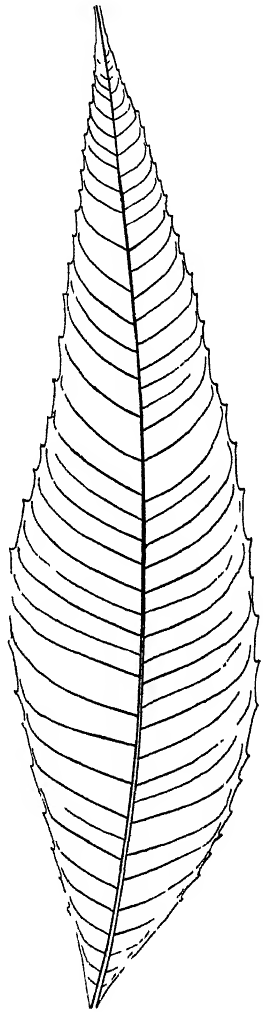


Fig. 2. A large leaf of *Inercus castaneopsis* Lesquereux. Two-thirds natural size.

Genus Dryophyllum Debey

Dryophyllum wyomingense Berry

Dryophyllum wyomingense Berry, 1930, U. S. Geol. Surv. Prof. Paper 165. p. 69, Pl. x, figs. 3–5.

This species, which comes from the supposed Bridger at Tipperary in the Wind River basin of Wyoming, has been described, as far as the available material will permit, in a recent paper to which the reader is referred. It is sparingly represented in the present collection from the Lysite.

Order Urticales

Family Moraceæ

Genus Ficus Linné

Ficus omballi Brown

Ficus omballi Brown, 1929, U. S. Geol. Surv. Prof. Paper 154, p. 285, Pl. lxxii, fig. 2.

This species was described by Brown from the Green River beds at a locality 30 miles northwest of De Beque, Colorado. In many respects it resembles some of the leaves (not the type) from Green River, Wyoming, which Lesquereux referred to *Ficus ungeri*,[1] as well as some of those from the Wind River basin of

[1] Lesquereux, L., 1883, Cret. and Tert. Flora, p. 163, Pl. xliv, fig. 2.

Wyoming which I referred to that species,[1] and it may be that there is some confusion, although this does not apply to the large wide leaves that have been referred to the latter species.

There are counterparts of the basal part of a relatively small leaf in the present collection from the Lysite which agree with Brown's species in form and venation but in which the basal part of the lamina is slightly more extended than his figured specimen. The petiole is preserved and is stout, about a centimeter in length, and expanded at the base.

Order SAPINDALES

Family Sapindaceæ

Genus SAPINDUS Linné

Sapindus obtusifolius Lesquereux

Sapindus obtusifolius LESQUEREUX, 1874, U. S. Geol. and Geog. Surv. Terr., Ann. Rept. 1873, p. 419. 1878 (not Lesquereux, 1885), Tertiary Flora, p. 266, Pl. XLIX, figs. 8–11. KNOWLTON, 1923 (not Knowlton, 1902), U. S. Geol. Surv. Prof. Paper 131, p. 166.

The type of this species came from eight miles southeast of Green River, Wyoming. It has been recorded by Lesquereux from Florissant, Colorado, and from the Fort Union of Dakota, and by Knowlton from the Mascall beds of Oregon. These are all almost certainly erroneous and were to all intents and purposes repudiated by Knowlton in his last discussion of the Green River flora (1923).

The present species is not very precisely delimited, although it is clear from one of the type specimens, which shows 10 subopposite leaflets attached to the stipe, that we have to do with a leaf of pinnate habit.

The Lysite material is a single leaflet and its counterpart. The species is otherwise confined to the Green River and has been found in both Wyoming and Colorado.

Order EBENALES

Family Ebenaceæ

Genus DIOSPYROS Linné

Diospyros mira Berry

Diospyros mira BERRY, 1930, U. S. Geol. Surv. Prof. Paper 165, p. 76, Pl. XIII, fig. 4; Pl. XIV, fig. 7.

This species was described from the so-called Bridger of the Wind River basin at Tipperary, Fremont County, Wyoming. The type

[1] Berry, E. W., 1930, U. S. Geol. Survey Prof. Paper 165, p. 70.

material was rather scanty and was identified as *Diospyros*, on the basis of its resemblance to other Eocene species in that genus and to the leaves of the existing *Diospyros virginiana* Linné. As there were some unnoticed typographical mistakes in the published description, and as the present material is somewhat larger, the species may be recharacterized as follows: Leaves of medium to large size, ovate, widest midway between the apex and the base, tapering equally and uniformly distad and proximad to the equally and shortly acute apex and base. Margins entire, evenly rounded. Leaf substance not thick but stiff and subcoriaceous. Length ranging from 8 to 14 centimeters. Maximum width 4.25 to 6 centimeters. Petiole stout, its length unknown, midvein stout, prominent, curved or slightly flexuous. Secondaries stout, 6 to 8 alternate pairs, fairly equally spaced, diverging from the midvein at angles of about 45°, curving regularly upward, and camptodrome in 2 or 3 diminishing arches. Tertiaries mostly obsolete, alike in the so-called Bridger and Lysite material.

The genus is an old and large one, ranging from the Upper Cretaceous to the present, and with many existing species, most of which are tropical although there are several exceptions in both hemispheres, our common eastern American *Diospyros virginiana* reaching northward as far as southern New England, and there is a well-marked late Miocene species, in Washington, represented by both leaves and fruit calices.

AMERICAN MUSEUM NOVITATES

Number 528 Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City May 23, 1932

59 9, 32 (728 1)

TWO NEW MAMMALS FROM GUATEMALA

BY GEORGE G. GOODWIN

The following descriptions are published in advance of a report on collections of Guatemala mammals recently secured by Mr. A. W. Anthony for The American Museum of Natural History. A detailed account of the entire collection will be given later.

My thanks are due to the Bureau of Biological Survey for the loan of comparative material and to Major E. A. Goldman who kindly compared the types with the large collections in Washington.

Sigmodon zanjonensis, new species

TYPE.—No. 69277, Amer. Mus. Nat. Hist.; female, ad.; Zanjon, Guatemala, 9000 feet elevation; January 8, 1925; collector, A. W. Anthony. The type is a skin and skull in good condition. I selected as the type, from a series of ninety specimens taken in the western highlands, a specimen which shows the strongest development of the characters peculiar to this form. However, only one specimen was taken at Zanjon.

GENERAL CHARACTERS.—In cranial characters *S. zanjonensis* approaches *S. hispidus saturatus* but differs in its uniformly grayer and somewhat less rufescent pelage and longer tail. In color it is more like *S. borucæ*, which is considerably larger and sufficiently different.

DESCRIPTION.—Pelage moderately long, soft and full. Color of upperparts including outer surfaces of arms and legs dull yellowish brown, darkened by long black guard-hairs, some of which, on the rump and sides, are tipped with yellow. Cheeks, legs, and shoulders slightly less darkened by long black hairs. Eye with indistinct narrow ring of yellow. Ears sparsely covered with fine white-tipped hairs. Tail distinctly bicolor, blackish brown above, white below. Underparts, including fore and hind feet and inner sides of legs and arms, white, the plumbeous bases of the hair showing through.

Skull short, compact, with heavy rostrum about as in *S. h. saturatus* but relatively narrower with molars perceptibly broader and more massive.

MEASUREMENTS OF TYPE.—Taken in the flesh: total length, 280 mm.; length of tail vertebræ, 124 mm.; length of hind foot, 30 mm.; ear, 16 mm. Skull: greatest length, 33.1 mm.; basal length, 29.5 mm.; length of nasals, 11.5 mm.; zygomatic breadth, 18.5 mm.; mastoid breadth, 13.55 mm.; aveolar length of upper molar series, 5.6 mm.

Sigmodon zanjonensis appears to be more closely related to *S. h. saturatus* than to any other described form, but its paler color, white underparts, and distinctly bicolor tail are alone sufficient to distinguish

it from that species. From *S. h. borucæ* it may be distinguished by its much smaller size and distinctive skull characters, and from *S. h. griseus* by its softer pelage and richer color.

Liomys anthonyi, new species

TYPE.—No. 79255, Amer. Mus. Nat. Hist.; female, ad.; Sacapulas, Central Guatemala, 4500 feet elevation; February 7, 1928; collector, A. W. Anthony. The type is a skin and skull in good condition.

GENERAL CHARACTERS.—Size medium for this genus; tail about equal in length to head and body, moderately haired and distinctly bicolor. General coloration rather pale, nearest to *L. salvini* but paler, especially the young, and without the distinctive slaty gray edging on outside of the forearm of the latter.

DESCRIPTION.—Upperparts uniform hair-brown grizzled with slender ochraceous-buffy hairs, this color extending down upper sides of hind limbs to ankles; heels dusky; ears hair-brown, narrowly edged with creamy white; underparts, including fore-limbs, hind feet, tip of nose, lips, and cheek-pouches creamy white; tail, dark brownish above, white almost to tip, which is dusky below.

Skull of moderate size, evenly arched, rostrum slender; nasals narrow, not expanded anteriorly. the sides nearly parallel and only slightly narrower posteriorly; ascending branches of premaxillæ slender and reaching well beyond nasals posteriorly; supraorbital ridges weakly developed; interparietal evenly oval, with small posterior emargination; dentition essentially as in *L. salvini.*

MEASUREMENTS.—Taken in the flesh: total length, 260 mm.; length of tail vertebræ, 133 mm.; length of hind foot, 32 mm.; ear, 12 mm. Skull: greatest length, 34.1 mm.; length of nasals, 13.8 mm.; zygomatic breadth, 15.35 mm.; interorbital breadth, 7.15 mm.; alveolar length of upper molar series, 5.1 mm.

Liomys anthonyi is closely related to *L. salvini*, but the paler color and absence of dusky edging on forearm is sufficiently distinctive; skull is much as in *L. salvini* but relatively longer, narrower and more evenly arched; with longer premaxilla which reaches farther beyond posterior border of nasals. Besides the type there are twenty paratypes showing very little individual variation. Sacapulas is a dry area at the foot of the high mountains and is surrounded by rain forest, which isolates it from other dry areas almost as if it were an island. I have named this species is honor of Mr. A. W. Anthony who collected the series.

AMERICAN MUSEUM NOVITATES

Number 529 — Published by The American Museum of Natural History, New York City — May 28, 1932

59. 9, 32 R (8)

THE TAXONOMIC HISTORY OF THE GENUS *REITHRODON* WATERHOUSE (CRICETIDÆ)

G. H. H. Tate

In course of preparation of a synoptic collection which the Department of Mammals of The American Museum of Natural History is bringing together, considerable taxonomic research has proved necessary. That part of the compilation dealing with the genus *Reithrodon* is believed to be complete and is now presented for the use of students of South American mammals.

HISTORICAL STATEMENT

1801. Azara described under the names "Rat quatrième au rat oreillard," a rat with large head, large ears and short tail, which appears to have been a *Reithrodon.*

1819. Desmarest applied the binomial *Mus auritus* (new species) to Azara's "Rat oreillard."

1830. Rengger described *Mus callosus* (n. sp.). (Synonymized by Trouessart in 1898 with *auritus*, but in 1916 removed by Thomas to *Hesperomys* as then restricted by him.)

1837. Waterhouse erected the genus *Reithrodon* (new genus), including in it *typicus* (n. sp.) and *cuniculoides* (n. sp.). Neither species was designated type of the genus.

1839. Waterhouse further characterized the genus, including in it, in addition to *typicus* and *cuniculoides*, *R. chinchilloides* (n. sp.) (removed later by Coues to *Euneomys*).

1843. Wagner included *cuniculoides*, *typicus* and *chinchilloides* in *Reithrodon.* He put *auritus* in *Hesperomys* but did not place it subspecifically.

1853. LeConte described a species of *Reithrodontomys* under the generic name *Reithrodon.*

1857. Baird, following LeConte, described several more *Reithrodontomys* as *Reithrodon.*

1874. Coues diagnosed *Reithrodon* critically. He removed *chinchilloides* to *Euneomys*, n. g., and designated (erroneously—see below, 1926) *cuniculoides* type species of the genus. Furthermore, he removed the *Reithrodontomys* of LeConte and Baird to "*Ochetodon*."

1879. Burmeister, apparently ignorant of the work of Coues, again listed *chinchilloides* under *Reithrodon* with *typicus* and *cuniculoides*. He placed *auritus* in *Calomys*, subgenus of *Hesperomys*.

1880. Thomas described *alstoni*, n. sp., referring it erroneously to *Reithrodon*, but suggesting at the same time that it might be wrongly referred.

1884. Thomas described *pictus*, n. sp. (eventually placed in *Auliscomys*).

1898. Trouessart made *Euneomys* a synonym of *Reithrodon*, listing under the latter: *typicus*, *cuniculoides*, *alstoni* (removed later to *Sigmomys*), *chinchilloides* (*Euneomys*), and *pictus* (*Auliscomys*). He made *callosus* and "*pyrrhogaster*"[1] synonyms of *auritus*, which he placed in *Phyllotis*.

1899. Thomas described *fossor*, n. sp. (later removed by him to *Euneomys* and subsequently designated by him type of *Chelemyscus*, n. g.).

1900. Philippi described *Mus pachycephalus*, n. sp., and *Reithrodon longicaudatus*, n. sp. (subsequently made the type of *Irenomys*, n. g., by Thomas).

1901*a*. Thomas removed *alstoni* from *Reithrodon* to *Sigmomys*, n. g.

1901*b*. Thomas compared *Reithrodon*, *Euneomys*, which he made a full genus, and *Sigmomys*. He removed *fossor* and *pictus* from *Reithrodon* to *Euneomys*.

1903. Allen compared *Reithrodon* and *Euneomys*.

1905. Allen further discussed the genus *Reithrodon* and *R. cuniculoides*. He described *cuniculoides obscurus*, n. subsp., and *hatcheri*, n. sp.

1905. Trouessart, following Thomas and Allen, now made both *Reithrodon* and *Euneomys* full genera. Under *Reithrodon* he listed *cuniculoides cuniculoides*, *cuniculoides obscurus*, *hatcheri* and *typicus;* but he placed *callosa* under *Eligmodontia* and barely mentioned *longicaudatus* in a footnote under *Phyllotis*.

---

[1]I find no such name as *pyrrhogaster* Wagner in the reference given by Trouessart (Abh Akad Wiss Munchen, V, p 313) On that page the only species listed is *Hesperomys brachyurus* Moreover, the name does not appear in Wagner, Schreber's 'Saugethiere,' Supplement, 1855 *Pyrrhogaster* Trouessart then appears to be a *nomen nudum*.

1910. Wolffsohn stated that *Mus pachycephalus* was equal to *Reithrodon cuniculoides* (but Philippi's animal being from Chile may be a distinct subspecies).
1912. Thomas described *cuniculoides flammarum,* n. subsp.
1916*a*. Thomas removed *callosus* to *Hesperomys* (restricted).
1916*b*. Thomas described *cuniculoides pampanus,* n. subsp.
1919. Thomas recognized *longicaudatus* Philippi and designated it type of *Irenomys,* n. g.
1920. Thomas alluded to Rat oreillard Azara (=*auritus* Desmarest), accepting it as a species of *Reithrodon.* He described *caurinus,* n. sp., *auritus marinus,* n. subsp., and *typicus currentium,* n. subsp.
1926. International Rules of Nomenclature, Art. 30, I, b., ruled that the names *typus* and *typicus* must be construed as type by original designation, thus making *typicus* Waterhouse the type of the genus *Reithrodon* and displacing *cuniculoides,* designated type by Coues (1874).
1927. Thomas described *cuniculoides evæ,* n. subsp.

PRESENT STATUS OF THE GENUS *REITHRODON* WATERHOUSE

Type by original designation (so construed, 1926), *Reithrodon typicus* Waterhouse.

List of Apparent[1] Species and Subspecies with Type Localities

R. typicus typicus Waterhouse	Maldonado, Uruguay
R. typicus currentium Thomas	Goya, Corrientes, Argentina
R. auritus auritus (Desmarest)	Pampas south of Buenos Aires, Argentina
R. auritus marinus Thomas	Mar de la Plata, southeast coast of Buneos Aires, Argentina
R. cuniculoides cuniculoides Waterhouse	Santa Cruz, Patagonia, Argentina
R. cuniculoides obscurus Allen	Punta Arenas, Patagonia, Argentina
R. cuniculoides flammarum Thomas	Spring Hill, Tierra del Fuego
R. cuniculoides pampanus Thomas	Peru, F. C. P., 200 km. northwest of Bahia Blanca, Buenos Aires, Argentina
R. cuniculoides evæ Thomas	Zapala, Nequen, Patagonia, Argentina
R. hatcheri Allen	Head of Rio Chico de Santa Cruz, Patagonia, Argentina
R. caurinus Thomas	Otro Cerro, Catamarca, Argentina

[1]No responsibility can be accepted for the allocation of the species listed. Such responsibility should be assumed only by a reviser working with ample material.

LIST OF REFERENCES

ALLEN, J. A.	1903.	Bull. Amer. Mus. Nat. Hist., XIX, p. 194.
	1905.	'Report Princeton Patagonian Expedition,' III, p. 62.
AZARA, F.	1801.	'Essais Quadr. Paraguay,' II, p. 91.
BAIRD, S. F.	1857.	'Mammals North America,' p. 447.
BURMEISTER, H.	1879.	'Descrip. Phys. Rep. Argentina,' III.
COUES, E.	1874.	Proc. Acad. Nat. Sci. Phila., p. 184.
DESMAREST, A. G.	1819.	Nouv. Dict. d'Hist. Nat., 2d Ed , XXIX, p. 64.
LECONTE, J. L.	1853.	Proc. Acad. Nat. Sci., Phila., VI, p. 413.
PHILIPPI, R. A.	1900.	Anales Mus. Nac. Chile, p. 42.
RENGGER, J. R.	1830.	'Naturg. Saug. Paraguay,' p. 231.
THOMAS, O.	1880.	Proc. Zool. Soc., London, p. 691.
	1884.	Proc. Zool. Soc., London, p. 457.
	1899.	Ann. Mag Nat. Hist., (7) IV, p. 280.
	1901*a*.	Ann. Mag. Nat. Hist., (7) VIII, p. 150.
	1901*b*.	Ann. Mag. Nat. Hist., (7) VIII, p. 254.
	1912.	Ann. Mag. Nat. Hist., (8) X, p. 411.
	1916*a*.	Ann. Mag. Nat. Hist., (8) XVII, p. 141.
	1916*b*.	Ann. Mag. Nat. Hist., (8) XVIII, p. 305.
	1919.	Ann. Mag. Nat. Hist., (9) III, pp. 199, 201:
	1920.	Ann. Mag. Hat. Hist., (9) V, p. 474.
	1927.	Ann. Mag. Nat. Hist., (9) XIX, p. 652.
TROUESSART, E.-L.	1898.	'Cat. Mamm. viv. foss.,'
	1905.	'Cat. Mamm. viv. foss.,' Supplement.
	1843.	Schreber's 'Saugethiere,' Supplement, III.
WAGNER, A.	1847.	Abh. Akad. Munchen, V, p. 306.
WATERHOUSE, G. R.	1837.	Proc. Zool. Soc. London, p. 29.
	1839.	'Zoology Voyage "Beagle,"' p. 68:
WOLFFSOHN, J. A.	1910	Bol. Mus. Nac. Chile, II, p. 101.

AMERICAN MUSEUM NOVITATES

Number 530 | Published by The American Museum of Natural History New York City | May 28, 1932

56.9 (116.8)

THE SUPPOSED OCCURRENCES OF MESOZOIC MAMMALS IN SOUTH AMERICA[1]

By George Gaylord Simpson

It is proposed to discuss here a few isolated supposed occurrences of mammals in the Mesozoic of South America. This is a question quite aside from that of the age of the *Notostylops* and related early mammalian faunas of Patagonia or that of the supposed survival of dinosaurs into the Tertiary there. Those mammalian faunas have been considered to be of Cretaceous age (Ameghino, Roth, and some other students accepting their conclusions) and have also been supposed to include dinosaurs, whatever the age. That problem is to be discussed in another note. Here are considered only occurrences of supposed mammals reported as coming from pre-*Notostylops* beds of undoubted Mesozoic age.

This is the first technical paper of the Scarritt Patagonian Expedition, being based chiefly on studies undertaken for the expedition in the Museo Nacional de Historia Natural Bernardino Rivadavia in Buenos Aires. As further results are published, fuller acknowledgment of indebtedness to many individuals and institutions will be made, but here special thanks must be expressed to Dr. M. Doello Jurado, Director of the Museo Nacional, for his constant and generous cooperation. Sr. Carlos Ameghino gave valuable advice and much unpublished data and Dr. Egidio Feruglio supplied full particulars regarding the discovery reported by him. In beginning publication it is also desired to express appreciation of the generous support of Mr. H. S. Scarritt and others who made this expedition possible.

The important supposed occurrences of South American Mesozoic mammals, under the conditions defined above, are as follows:

1. Hatcher's find in the barrancas of the Río Tarde near Lago Pueyrredon.
2. Ameghino's famous "*Proteodidelphys* fauna," supposedly from the Chubutiano of the Chubut Valley.
3. Supposed cetacean teeth reported by Ameghino from the Salamanqueano Formation.
4. Supposed mammals from Mesozoic strata in Jujuy reported by Feruglio.

The reported horizons are not all of exactly known age, but all are surely Mesozoic. The inquiry, then, is (1) whether the specimens in

[1]Publications of the Scarritt Patagonian Expedition, No. 2

question are really mammalian, and (2) whether they actually came from the stated horizon.

The conclusions reached are (1) that most or all of the specimens of the *Proteodidelphys* fauna are mammalian, while the others (all of which have been lost) probably were not, and (2) that the *Proteodidelphys* fauna was not really derived from Mesozoic beds, while the others probably or surely were. It therefore appears that all these reports are highly dubious or incorrect and that Mesozoic mammals are not yet surely known from South America. It is not intended to deny that they occurred there or that their remains will eventually be found, which is quite probable. The intention is only to erase from the record several important errors or statements so dubious as to be of no value. The oldest mammals now known from South America are derived from beds belonging to or immediately below the *Notostylops* complex and are of distinctly Tertiary aspect. They will be described and illustrated in a later publication.

HATCHER'S SUPPOSED RÍO TARDE MAMMALS

Hatcher (1900, p. 90) in discussing his Belgrano Beds, Pueyrredon Series, says "A few imperfect plant remains were also found and a very few small, trituberculate teeth were discovered associated in the same rock with remains of Ammonites. These trituberculate teeth may perhaps pertain to mammals." The invertebrates were studied by T. W. Stanton, who placed them as not earlier than about the middle of the Cretaceous. Hatcher continues, "The Cretaceous age of these beds as determined by Stanton from a study of the invertebrate collections is significant, since Dr. Ameghino, after seeing two of the small teeth collected by myself from them, immediately referred this entire series of beds to the Jurassic."

There were repeated references to these beds and to the supposed mammals, but for the most part they are unimportant here. Ameghino's definitive opinions appear in the "Formations Sédimentaires" (1906), as follows (p. 464–465):

"Faune Tardéenne

"Les plus anciens débris de Mammifères connus jusqu'à présent de Patagonie, viennent du crétacé inférieur de la région du lac Pueyrrédon. Ici, dans les hautes falaises du Río Tarde, le regretté naturaliste M. Hatcher trouva, emboîté dans la même roche que les Ammonites, un certain nombre de petites molaires biradiculées . . . avec couronne

à une cuspide centrale plus haute et deux ou trois cuspides latérales et avec l'émail à surface ridée d'une manière très apparente. J'ai référé ces débris à un précurseur probable des Zeuglodontes. . . . Il est regrettable que mon éminent collègue et ami, M. le Prof. W. B. Scott, qui possède ces débris n'en ait pas encore donné une description."

The desired description never was given, and I have been informed by Dr. G. L. Jepsen (personal communication) that the specimens were so poorly preserved as hardly to warrant description and are not now to be found in the Princeton collections. Essentially all we know of them, then, is the brief description given in the above passage by Ameghino, who had himself seen the specimens. The description is far from diagnostic of mammalian teeth. On the contrary, no known Mesozoic mammals agree very closely. It is suggestive of certain sharks, such as the hybodonts, a suggestion the more probable in view of the fully marine nature of the beds. In any event, the serious doubt as to their identification, their poor preservation and their subsequent loss deprive these teeth of right to serious consideration as mammals. The "Faune Tardéenne" must be erased from the squence of Patagonian mammalian faunas at least until further collecting has been done.

THE *PROTEODIDELPHYS* FAUNA

The few remains on which Ameghino established his "*Proteodidelphys* Fauna" are the most important and interesting. Unlike all the other specimens here considered, they are still available for study; they include at least one really identifiable specimen; and they have been almost universally accepted as of Mesozoic age. On them Ameghino erected a fantastically complex structure of theories as to morphology, phylogeny, and stratigraphy. One species, *Proteodidelphys præcursor*, figures as the base of several of his phylogenetic trees and among the bases of his studies in dental morphology. Another, *Archæoplus incipiens*, is supposed to demonstrate the imperfect separation of ungulates and marsupials at that time. The actual material on which these and other equally important conclusions rest is as follows.

1. *Proteodidelphys præcursor*, type an excellent lower jaw.
2. *Archæoplus incipiens*, type an isolated incisor.
3. Another unnamed incisor of different character.
4. A fragmentary dermal plate.
5. A broken edentate tooth.
6. A small hard ball of doubtful nature.

Some further notes on these specimens may preface consideration of their origin.

Proteodidelphys præcursor Ameghino, 1898

P. præcursor, AMEGH., 1898, pp. 117, 187, fig. 52*b*; 1900, pp. 201, figs. 2–5; 1902A, pp. 6–7; 1902B, p. 21, figs. 1–3; 1902C, p. 421, figs. 1–2, 15; 1903, p. 161, figs. 82, 84, 88; 1904, p. 53, figs. 50–51; 1906, p. 288, fig. 69.

P. præcursor, SIMPSON, 1929, p. 130.

TYPE.—Museo Nacional (Buenos Aires) No. 10799, right lower jaw with I_2–M_4.[1]

CHARACTERS.—Dental formula $I_4\,C_1\,P_3\,M_4$. Incisors subequal, spaced, spatulate. Canine erect, root single but grooved, somewhat recurved crown, inner side excavated, very slight rudiment of internal heel. Premolars progressively larger, P_1 to P_3. Molars of generalized didelphid pattern, trigonid little elevated above talonid. Protoconid larger than metaconid, metaconid larger than paraconid. Talonid

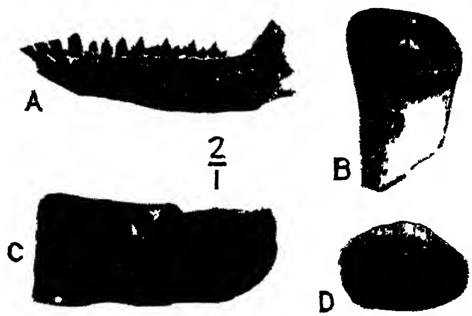


Fig. 1. The "*Proteodidelphys* Fauna."

A. *Proteodidelphys præcursor* Ameghino. Right lower jaw, internal view. Type, M. N. H. N. No. 10799.

B. *Archæoplus incipiens* Ameghino. Incisor, internal view. Type, M. N. H. N. No. 10801.

C. Fragment of dermal scute referred by Ameghino to the Peltephilidæ. External view. M. N. H. N. No. 10800.

D. Edentate tooth. Crown view. M. N. H. N. 10798.

All enlarged two diameters. Photographs from the Museo Nacional de Historia Natural, Buenos Aires.

typically didelphid on $M_{1\text{-}3}$. $M_{1\text{-}2}$ subequal, M_3 somewhat smaller, and M_4 very small and with greatly reduced talonid, shorter and narrower than trigonid and with only one really distinct cusp. Horizontal ramus of moderate proportions, symphysis extending to between canine and P_1, fused, mental foramina under $P_{1\text{-}2}$ and anterior end of M_1.

DISCUSSION.—The tremendous morphological importance given this specimen by Ameghino seems to me wholly unjustified. Except for the characteristic specialization of M_4, it is, indeed, a primitive and

[1] I_1 and part of the posterior end of the jaw have been lost since the specimen was first figured.

generalized type of marsupial, but there are species just as primitive in every respect, at least as late as the Santa Cruz. There is no way in which *Proteodidelphys* can be distinguished generically from the common *Eodidelphys*. Certain specimens from the Santa Cruz formation referred by Ameghino to *Eodidelphys famula* cannot surely be distinguished specifically: size, structure, and position of each tooth, depth and form of mandible, position and size of mental foramina, even the non-essential characters of color and mode of preservation, are all nearly identical. Given the static nature of the didelphids as a whole, this perhaps does not mean that the present specimen is not older than the Santa Cruz, but it certainly makes it highly improbable that it is greatly older and robs the specimen of any particular morphological interest.

Technically it would perhaps be necessary to reduce the names of this genus and species to synonymy, as they cannot be defined in a diagnostic way, but in view of their history and the doubt that still clouds their true significance, it seems to me practical and permissible to retain them tentatively.

Archæoplus incipiens Ameghino, 1898

A. incipiens, Amegh., 1898, pp. 117, 174; 1900, p. 200, fig. 1.
A. incipiens, Simpson, 1929, p. 130.
Type.—Museo Nacional (Buenos Aires) No. 10801, isolated incisor.

Discussion.—The tooth has been fully described and adequately figured by Ameghino. He pointed out its noteworthy resemblance to the incisors of *Isotemnus* and *Trimerostephanos* (primitive homalodontotheres of the *Notostylops* and *Pyrotherium* faunas, respectively), yet largely on this single tooth based a theory of derivation of ungulates from marsupials and repeatedly stated categorically that it shows the beginnings of this differentiation. There is considerable resemblance to isotemnid incisors, although I find no identical tooth in the available material. Closest comparison seems rather to be with upper incisors of the Archæohyracidæ. The specimen is inadequate for generic or specific determination, but there is no reason to suppose it anything but a normal notoungulate of Lower Tertiary type, perhaps of the family Archæohyracidæ.

Unnamed Specimens

Museo Nacional No. 10798 is a broken edentate tooth. The section is oval, measuring 8 by 5.5 mm., the vertical axis slightly curved. There is a thin ring of harder dentine, vitreous as fossilized. Cement is thin or absent, although perhaps corroded away. This could be either a dasy-

pod or a gravigrade, and there are genera from the *Notostylops* beds to the Pleistocene to which it could belong. With it is a small, hard, yellow nodule, perhaps placed here by Ameghino as a possible dermal ossicle, but more probably a concretion or a coprolite.

Museo Nacional No. 10800 is a fragmentary dermal scute. It is unusually thin, smooth on one side, pitted on the other. So little is preserved, and that little is so nondescript, that it might about equally well be dasypod, reptilian, or even piscine. Ameghino referred it to the Peltephilidæ.

Preserved with the types of *Archæoplus incipiens* is another very different tooth. It has a single long conical root, smooth neck, and slightly asymmetrical crown, one side convex, the other excavated along two sides. It is indeterminate, but is probably a litoptern incisor, of no particular stratigraphic or morphologic interest.

Origin of the "Fauna"

In his frequent references to these specimens, Ameghino said only that they came from the "areniscas abigarradas," that is, from what is now called the Chubutiano or "Lower beds with dinosaurs" of the lower Chubut Valley. He gave no data in support of this statement. From his phrasing, such as "en un tercer yacimiento se encontraron también algunos restos de mamíferos" (1900, p. 198), it is fairly clear that no associated fossils were found, and he would hardly have omitted so important an association if it occurred.

Since I have encountered almost no instances of Carlos Ameghino's being mistaken as to the relative levels of the fossils found by him, when positively affirmed, there would be a strong presumption of accuracy if he had collected these specimens. It has generally been assumed that he did so, no contrary statement being published, but such is not the case. He himself states (personal communication) that they were collected by Nicolás Illin, an employee of the Museo de La Plata, and that it is Carlos Ameghino's opinion that they probably were not from the Chubutiano. Don Carlos states that he never found any trace of mammals in the Chubutiano, and this is the experience of all other collectors except Illin.

In the absence of associated fossils or any other concrete data, it is to be presumed that the horizon was determined by inference from lithology or similar criteria. In this case lithology is of no value, since in this region (as suggested by the work of Roth, who, however, drew quite different conclusions, and as fully proven by the work of our expedi-

tion) there are beds nearly or quite identical in appearance with the Chubutiano, but of much later, Tertiary age.

The preservation of the several specimens is very different, not of great importance but suggesting that they were not found together and still further reducing the chances that they really characterize any one known horizon or that they were in place.

The fossils themselves do not at all suggest Cretaceous age. On the contrary, all are of Tertiary aspect, and the only one that is identifiable is inseparable from a Santa Cruz species. It is improbable that they are from the Santa Cruz, as that formation is not known to occur in this area and as it is improbable that even a careless collector would fail to realize that he was above the characteristic marine Patagoniano, but they could well be of *Notostylops*, *Astraponotus*, *Pyrotherium*, or *Colpodon* age, all of which occur in or near the Chubut Valley and all of which may or do contain similar mammals.

To sum up, there is no real evidence that these mammals are of Cretaceous age and there is much opposing evidence. Until or unless further evidence becomes available, it seems established with great probability that the "*Proteodidelphys* fauna" is from the Tertiary and has no unusual faunal or stratigraphic significance.

SUPPOSED CETACEANS FROM THE SALAMANQUEANO

Ameghino thought the Salamanqueano and the *Notostylops* beds to be contemporaneous in part and even reported land mammals of the *Notostylops* fauna in the Salamanqueano. This is certainly erroneous, and need not be discussed further here. The Salamanqueano is a marine formation of Cretaceous, probably late Senonian age. Whatever their exact correlation, the *Notostylops* beds are unequivocally of considerably later age. The supposed mingling of the two faunas is an error, and was not based on the work of the Ameghinos themselves.

The occurrence of supposed cetaceans in the Salamanqueano is on a different basis. They were found by Carlos Ameghino. As his field data are almost invariably correct and as the Salamanqueano is very easily recognized, this may be accepted as their true horizon. The specimens themselves were not found in the Ameghino collection during an exhaustive search in 1931. The only published data are as follows (Ameghino, 1906, p. 466):

"Dans les couches marines correspondant à la partie la plus inférieure (étage Salamanquéen) fait son apparition le plus ancien des Cétacés connus, le *Proterocetus*, de taille excessivement réduite."

Ameghino apparently never applied a specific name and never gave any description. This formation happens to contain numerous fish teeth, some of which do have somewhat the appearance of minute cetacean teeth, although surely selachians or other fishes. These facts, the reported extremely small size, the only character given by Ameghino, and the general very great *a priori* improbability of cetaceans here make the report unworthy of credence. Furthermore Carlos Ameghino (in conversation) states that he remembers the specimens and believes them to have been teeth of some fish.

SUPPOSED MAMMALS FROM MESOZOIC BEDS IN JUJUY

Feruglio (1927) reported the occurrence of a small, incomplete mandibular ramus, a fragment of another mandible, and a small scapula collected by him in beds either Jurassic or Lower Cretaceous at the railroad station Quemado near the town San Pedro de Jujuy, Province of Jujuy, Argentina.[1] The preliminary note gives no descriptions, only suggesting affinities with the Dromatheriidæ, Triconodontidæ, and "Pantotheriidæ," suggestions which give no conception of the real characters of the material, as the first mentioned group is not mammalian at all and the latter two are very different from each other. As detailed study was intended at a later date, no notes, drawings, photographs, or measurements were taken, and the fossils themselves subsequently disappeared under circumstances which make their rediscovery extremely improbable, having been stolen with some personal effects.

Feruglio (1931) later referred to the specimens in these words: "A estos hallazgos [of fishes and reptiles by Brackenbusch and Steinmann] debe agregarse el por mí efectuado (Feruglio, 1927) en la cantera de asfalto de Garrapatal (San Pedro de Jujuy). Los fósiles aquí recolectados consistían de una rama mandibular algo incompleta y de un fragmento de otra, los que, en base a un primer examen, he apreciado pertenecer al grupo de los mamíferos primitivos. Por una desgraciada circunstancia, estos fósiles se perdieron antes de que tuviera la oportunidad de estudiarlos más detenidamente y figurarlos gráficamente; siendome impossible, en consecuencia, proporcionar una descripción de los mismos."

As Doctor Feruglio remembers them (personal communication), the fossils do not seem to me to have presented unequivocal mammalian characters.

[1]I am indebted to Dr L S Russell for first calling my attention to this occurrence, sending a translation of Doctor Feruglio's paper, and to Dr Feruglio himself for much unpublished data

The only further fact of possible bearing on the situation is the recent description by Von Huene (1931, p. 183) of a small jaw from the same formation although from a somewhat higher horizon. This jaw, *Carlesia incognita* v. Huene, 1931, has somewhat the general aspect of a Mesozoic mammal, but on closer study proved to be a reptile, apparently a lacertilian. It is at least possible that Feruglio's discovery was of similar nature, and judgment must be suspended for the present. Further discoveries at this locality would be of great interest.

REFERENCES

AMEGHINO, F. 1898. Segundo censo de la República Argentina. Cap. I. Territorio. 3ª Parte. Sinopsis geológica-paleontológica. Pp. 113–255. Buenos Aires.

1900. Mamíferos del cretáceo inferior de Patagonia (Formación de las areniscas abigarradas). Comunicaciones Mus. Nac. Buenos Aires, I, pp. 197–206.

1902A. Notices préliminaires sur des mammifères nouveaux des terrains crétacés de Patagonie. Bol. Acad. Nac. Cien. Córdoba, XVII, pp. 5–70.

1902B. Línea filogenética de los proboscídeos. Anales Mus. Nac. Buenos Aires, VIII (Ser. 3ª, I), pp. 19–43.

1902C. Sur le type primitif des molaires plexodontes des mammifères. Anales Mus. Nac. Buenos Aires, VIII (Ser. 3ª, I), pp. 419–439.

1903. Los diprotodontes del orden de los plagiaulacoideos y el origen de los roedores y de los polimastodontes. Anales Mus. Nac. Buenos Aires, (3) II, pp. 81–192.

1904. Recherches de morphologie phylogénétique sur les molaires supérieures des ongulés. Anales Mus. Nac. Buenos Aires, IX (Ser. 3ª, III), pp. 1–141

1906. Les formations sédimentaires du crétacé supérieur et du tertiaire de Patagonie avec un parallèle entre leurs faunes mammalogiques et celles de l'ancien continent. Anales Mus. Nac. Buenos Aires, XV (Ser. 3ª, VIII), pp. 1–568.

FERUGLIO, E. 1927. Rinvenimento di resti di mammiferi nel Giurese dell' America meridionale. Boll. Soc. Geol. Italiana, XLVI, pp. 111–112.

1931. Observaciones geológicas en las provincias de Salta y Jujuy. Direc. Gen. Yac. Petrol. Fisc., Cont. 1ra Reun. Nac. Geog., VII, pp. 5–39.

HATCHER, J. B. 1900. Sedimentary rocks of southern Patagonia. Amer. Jour. Sci., (4) IX, pp. 85–108.

HUENE, F. VON. 1931. Verschiedene mesozoische Wirbeltierreste aus Südamerika. Neues Jahrb. Min. etc., Beil.-Bd. LXVI, Abt. B, pp. 181–198.

SIMPSON, G. G. 1929. American Mesozoic Mammalia. Mem. Peabody Mus. Yale Univ., III, pp. 1–235.

AMERICAN MUSEUM NOVITATES

Number 531 | Published by The American Museum of Natural History, New York City | May 28, 1932

59.88, 1 P (96)

BIRDS COLLECTED DURING THE WHITNEY SOUTH SEA EXPEDITION. XXI[1]

NOTES ON THICKHEADS (*PACHYCEPHALA*) FROM POLYNESIA

By Ernst Mayr

In a previous paper I discussed the classification of the thickheads from the Solomon Islands, and attempted to clarify the various taxonomic problems of this group. Practically the same questions arise with regard to the Polynesian members of the genus *Pachycephala*. Here, also, we find distinct and isolated forms on the one hand, and, on the other, groups of closely related populations. In these cases I apply the same principles that I used when dealing with the Solomon Islands forms. Concerning my methods of measurements, nomenclature of colors, and arrangement, I have followed the plan of the previous papers. I am greatly indebted to Mr. John T. Zimmer (New York), Norman B. Kinnear (London), and Jacques Berlioz (Paris), for much assistance and information.

Pachycephala in the New Hebrides and Banks Islands

The New Hebrides and Banks Islands are inhabited by a group of thickheads that show pronounced heterogynism. The males from the twenty islands from which I have examined collections show great uniformity and are in most cases indistinguishable; the females, however, although not strikingly different from each other, have characteristics of their own on almost every island. The variation is irregular, as usual in the New Hebrides, and no distinct tendency can be noticed in following the chain of islands from the south to the north. On the contrary, birds from the southern islands (Efate) are more similar to birds from the northern-most islands (Banks Islands) than to those from intermediate localities. An added problem is the individual variation, especially the occasional occurrence of a brownish phase. Such brownish coloration occurs in females now and then in almost any subspecies of *Pachycephala pectoralis*, but it sometimes affects the majority of the

[1]Previous papers in this series comprise American Museum Novitates, Nos. 115, 124, 149, 322, 337, 350, 356, 364, 365, 370, 419, 469, 486, 488, 489, 502, 504, 516, 520, and 522.

specimens. Such brownish populations are found in the New Hebrides for example on the islands of Efate and Aoba.

Thus far three names have been given to the thickheads of these islands, but one of them obviously by mistake, for Gray described the male and female as two different species. The material at hand permits a thorough study, and although every arrangement is somewhat artificial, five groups can be defined. The only alternative would be to ignore the differences altogether and unite the birds from the whole region under one name.

Pachycephala pectoralis cucullata (Gray)

Eopsaltria cucullata G. R. Gray, 1859, 'Cat. Birds Trop. Islands,' p. 21, Aneiteum [description of female].

Adult Male.—Similar to males of *chlorura* from Efate (see p. 3), but black on head and breast-band duller, feathers of crown and hind neck with rufous olive edges; olive of back duller, olive on edges of secondaries, on upper tail-coverts, and on tail washed with brownish, not pure olive.

Adult Female.—Somewhat similar to females of *chlorura* from Efate, but duller and more brownish; crown brownish, ear-coverts rufous cinnamon; back dull brownish-olive; throat white, some feathers with narrow pale brown tips; breast-band light grayish-brown and narrow; belly pale lemon-yellow with a slight tinge of ochre; yellow of under tail-coverts scarcely deeper; wing-coverts and wing-feathers edged with cinnamon-olive.

Immature Female.—Similar to adult, but bill brownish; wing-feathers softer and more brownish; upperside duller and underparts less yellowish.

Tarsus, 25–26; culmen, from base 19–19.5, exposed 12–13 (in adult males).

	Wing	Tail
2 ♂ ad.	89, 89	67, 67
2 ♀ ad.	84, 86.5	63, 65

Range.—Aneiteum Island, southern New Hebrides.

This form was originally described from a single female and considered a distinct species of *Eopsaltria* by many subsequent authors until Wiglesworth[1] in 1899 discovered its real systematic position. From that time on, *cucullata* was put into the synonymy of *chlorura*. It is doubtful, however, if this is the correct procedure, as the collections of the Whitney Expedition prove that the thickheads show a great deal of local variation in the New Hebrides. It is almost certain that the Erromango birds are not the same as the Aneiteum birds. The Whitney material from Aneiteum is unfortunately very meager, but the characters mentioned above were substantiated by Mr. Norman B. Kinnear (London), who compared my material with that of the British Museum. He writes

[1]Bull. Brit. Orn. Club, VIII, p. 44.

me that my two Aneiteum females agree very closely with the type of *cucullata*, and "the only differences appear to be that their heads are of a slightly browner tint, while the white on the underside and the yellow wash on the belly are not so pronounced," differences that may be due to the age of the type. The differences in the male plumage between the Efate birds and those from Aneiteum (as mentioned above) are also confirmed by the material of the British Museum, except for one adult male from Aneiteum, which is indistinguishable from Efate males.

Pachycephala pectoralis chlorura Gray

Pachycephala chlorurus G. R. Gray, 1859, 'Cat. Birds Trop. Islands,' p. 20, "New Hebrides (Erromango, Aneiteum)," type locality hereby restricted to Erromango.

Adult Male.[1]—Forehead, crown, hind neck, lores, upper cheeks, ear-coverts, and narrow breast-band black; yellow nuchal collar narrow, in the middle mixed with olive; back, rump, scapulars, edges of wing-coverts, and secondaries citrine olive, edges of primaries partly grayish; throat white; breast, abdomen, and under tail-coverts rich lemon-yellow; axillaries and under wing-coverts white with light yellow tinge; tail dull citrine, blackish subterminal band across the lateral tail-feathers.

Adult Female.[1]—Crown more grayish olive, not brownish as in *cucullata;* ear-coverts brownish gray; back dull olive-citrine, without a distinct brownish tinge; edges of wing-feathers and tail-feathers dull citrine with less admixture of brownish than in *cucullata:* throat white, some feathers with very light and narrow grayish tips; breast-band light, narrow and grayish; belly pale lemon-yellow (about as in *cucullata*)), in two of six specimens mixed with ochre; yellow of under tail-coverts distinctly richer and darker than that of belly.

Immature Male and Female.—Similar to adult female, but belly lighter, with only a very slight tinge of yellow; olive of upperparts duller, crown strongly mixed with olive; secondaries and wing-coverts more or less rufous brown; in addition to these color characters there are the usual signs of immaturity in thickheads, as light bill, pointed tail-feathers, and soft and rounded wing-feathers.

Tarsus, 25–26; culmen, from base 19–20, exposed 12–13 (in adult males).

Efate Island	Wing	Tail
15 ♂ ad.	83–88(85.5)	61–65(63.1)
6 ♀ ad.	80–85(82.4)	59–63(61.4)
4 ♂ im.	83, 84, 85	63–64(63.5)
4 ♀ im.	81–85(83.2)	61–64(62 5)

Range.—Erromango. For the present, I refer birds from Efate and Nguna Island to this race also.

The material on which Gray based the description of *P. chlorura* consisted apparently of two adult males, one from Erromango and one from Aneiteum (specimens *a* and *b*, in 'Cat. Birds Brit. Mus.,' VIII,

[1]The following descriptions are based on specimens from Efate.

p. 195). All the other material collected by Macgillivray and Brenchley was acquired by the British Museum a long time after the description of *chlorura*. The two original specimens have therefore to be considered as the cotypes of this species, and Gadow (ibidem, p. 195), as well as Sharpe (Ibis, 1900, p. 343), was not justified in calling the Erromango specimen the type. Everything depends in such cases on what the first reviser fixes as the type locality. A careful study of the existing literature reveals that the type locality has not been restricted up to the present.

The problem as it now stands is as follows: the males from the different islands cannot be distinguished with certainty; females, however, are not known from Erromango. The status of the Erromango Island race will remain doubtful, therefore, if Erromango be designated as type locality. On the other hand, Erromango has been considered, although erroneously, the type locality for so many years that it does not seem advisable to change it. I, therefore, restrict the type locality to Erromango, by which action the specimen *a* of the British Museum automatically becomes the type of *chlorura*.

Mr. Kinnear writes me that the type of *chlorura* can not be distinguished from Efate males, and we have to call the Efate specimens *chlorura* until a series of females becomes known from Erromango. Judging from other cases, it is rather probable that the Erromango and Efate birds are not the same, but this cannot be settled without a series of typical females.

Pachycephala pectoralis brunneipectus, new subspecies

TYPE.—No. 212778, Amer. Mus. Nat. Hist.; ♀ ad.; Epi Island, August 5, 1926; R. H. Beck and J. G. Correia.

ADULT MALE.—Like that of *chlorura* from Efate.

ADULT FEMALE.—Similar to that of *chlorura* from Efate, but breast-band more brownish and much wider; belly very pale yellow, under tail-coverts much deeper yellow (about empire yellow, R.IV); ear-coverts and crown very much more brownish than in *chlorura* from Efate; crown between snuff-brown (R.XXIX) and olive-brown (R.XL), ear-coverts lighter and less olive; back brownish olive, instead of greenish; olive edges of wing-feathers also more brownish.

IMMATURE MALE[1] (I. Phase).—Similar to adult female, but mandible yellow, maxilla brownish yellow; edges of wing-feathers and wing-coverts rufous; tail-feathers narrow and very pointed; throat with a faint yellowish wash; breast-band grayish olive; crown strongly washed with olive, contrasting with the more brownish ear-coverts; belly lighter yellow; back as in adult female.

IMMATURE MALE (II. Phase).—Bill black, throat white, a few feathers with dark tips; breast-band grayish, some feathers partly blackish; belly deeper yellow than in

[1]About the different male plumages of *Pachycephala* see: Mayr, 1932, Amer. Mus. Novit., No. 522, p. 11.

adult females, some almost as deep as in adult males; crown brownish as in adult females, but many feathers partly blackish; back, tail, and edges of wing-feathers more greenish than in females, but duller than in adult males.

IMMATURE FEMALE.—Very similar to immature male (I. Phase), but bill more brownish; head more brownish, less olive.

Tarsus, 25; culmen, from base, 20.

	WING	TAIL
15 ♂ ad.	84–89(87 0)	62–69(65 2)
4 ♂ imm. (II. Phase)	85–86(85 8)	62–65(64.0)
2 ♂ imm. (I. Phase)	82, 84	65, 65
9 ♀ ad.	83–89(86 0)	64–68(65.4)
4 ♀ imm.	81–84(82 5)	63–68(65 5)

RANGE.—Epi group in the New Hebrides (Mai, Tongariki, Epi, Lopevi, Pauuma, and Ambrym).

The birds from these six islands form a very uniform population.

Pachycephala pectoralis intacta Sharpe

Pachycephala intacta SHARPE, 1900, Ibis, p. 343, Sandwich Bay, Mallicolo [Malekula], New Hebrides.

ADULT MALE.—Almost identical with that of *chlorura* from Efate, but back usually more yellowish olive.

ADULT FEMALE.—(Malekula; 10 specimens). Characterized by the reduction of the lipochrome on abdomen and back; head brownish, darker and more cinnamon than in *brunneipectus;* ear-coverts duller brownish without any olive tinge; back dull brownish-olive, resembling that of *cucullata,* but more greenish toward the rump and without a rufous tinge; breast-band light and narrow as in *chlorura* from Efate, but brownish as in *brunneipectus,* not grayish; belly whitish, washed with pale lemon, edges of some feathers stronger yellow; under tail-coverts rich yellow, contrasting with the light-colored belly.

The birds from several other islands can be included in this race, but they differ slightly in the coloration of the females:

Santo (10 females examined).—Similar to typical *intacta,* but abdomen usually more strongly washed with yellow; breast-band, head and ear-coverts slightly more rufous; back averaging richer olive; white feathers of throat with broader cinnamon

Malo (3 females examined).—In general intermediate between Malekula and Santo birds, but closer to Santo examples; on abdomen with more yellow than either.

Aoba (5 females examined).—The birds from Aoba are somewhat intermediate between this and the following subspecies. They have the belly as light-colored as the Malekula birds, but have crown and sides of the head much more grayish; four of the five females belong to a brown phase, which occurs frequently in this genus; they have flanks, wing-feathers, and tail-feathers strongly washed with brownish.

IMMATURE MALE (I. Phase).—Differs from adult female as in the other subspecies (see p. 4). Throat in this subspecies, however, only rarely washed with yellow; edges of primaries with only little brownish wash.

IMMATURE MALE (II. Phase).—Intermediate between immature (I. phase) and adult.

JUVENAL MALE.—One specimen (No. 218010) has still some of the rufous feathers of the juvenal plumage on breast, flanks, under tail-coverts and hind neck.

IMMATURE FEMALE.—Except for the usual characters of immaturity (on bill, wing and tail), similar to the adult female, but crown more olive and abdomen almost pure white.

			Wing	Tail
Malekula	10	♂ ad.	86–90(87.5)	61–67(64.7)
	6	♂ imm. (I. Phase)	80–85(82.5)	60–67(63.0)
	10	♀ ad.	83–88(85.0)	61–63(62.2)
	5	♀ imm.	80–83(82.4)	62–64(63.0)
Malo	3	♂ ad.	82, 84, 85	60, 62, 63
	3	♀ ad.	81, 83, 85	58, 61, 61
Santo	10	♂ ad.	83–87(85.0)	60–64(62 8)
	10	♀ ad.	81–86(82.9)	58–64(60.5)
Aoba	8	♂ ad.	85–87(86.4)	63–65(63 8)
	5	♀ ad.	83–85(84.8)	61–64(63 0)

RANGE.—Malekula, Malo, Santo, Dolphin, and Aoba Islands, New Hebrides.

Pachycephala pectoralis banksiana, new subspecies

TYPE.—No. 216029, Amer. Mus. Nat. Hist.; ♀ ad.; Vanua Lava, Banks Islands; November 10, 1926; R. H. Beck and J. G. Correia.

ADULT MALE.—Similar to that of *chlorura* from Efate, but back usually duller and more greenish, less olive.

ADULT FEMALE.—Similar to that of *chlorura* from Efate, but head purer grayish-olive, with very little brownish; back darker and more greenish, less olive; breast-band light and narrow, more brownish and less grayish than in *chlorura* from Efate; differs from *intacta* by the yellow-colored belly.

Immature birds differ from the adults as in the other subspecies.

			Wing	Tail
Vanua Lava	4	♂ ad.	85–88(86.8)	61–64(62.8)
	8	♀ ad.	83–87(84.5)	57–62(60.5)
Bligh	3	♂ ad.	85, 85	62, 63
	5	♀ ad.	83–84(83 8)	59–61(59.8)
Gaua	2	♂ ad.	88	63, 64
	3	♀ ad.	85, 86, 88	62, 63, 64
Aurora	4	♂ ad.	88–90(88.8)	65–68(66.2)
Pentecost	4	♂ ad.	86, 87, 87	65–67(66.0)
	3	♀ ad.	88	62, 63, 66

RANGE.—Banks Islands (Vanua Lava, Bligh, and Gaua), and probably also northern New Hebrides (Aurora and Pentecost).

The birds from Bligh and Vanua Lava are typical. Specimens from Gaua have the belly lighter yellow and the head more brownish, thus approaching *intacta*. Three females from Pentecost are very worn, but

show in their characters more affinity to *banksiana* than to *intacta* or *brunneipectus;* they have a light and narrow breast-band, a yellowish belly and a gravish (brown) head. I provisionally unite, therefore, the specimens from Pentecost and Aurora with *banksiana.*

The specimens from Aurora and Pentecost are also slightly larger and have longer tails.

As a whole, this subspecies is very similar to *chlorura* from Efate, and I would not describe it, if it were not separated from the range of *chlorura* by the ranges of *brunneipectus* and *intacta.*

Most of the specimens were collected in November, shortly before the molting period; those collected in January are in full molt.

Pachycephala in the Santa Cruz Group

The Santa Cruz Islands are inhabited by three well-defined forms of thickheads which seem to be more closely allied to the thickheads from the Fiji group than to those from the New Hebrides. Considering the small distance between Vanikoro, Utupua, and Santa Cruz, the distinctness of these three forms is very remarkable.

Pachycephala pectoralis vanikorensis Oustalet

P. [*achycephala*] *vanikorensis* Oustalet, 1877, Bull. Soc. Philomath., (6) XI, p. 95, (1875), Vanikoro Island.

Adult Male.—Similar to *banksiana*, but back deeper olive, less yellowish; black breast-band on the average wider; tail not olive, but mostly black, only tips and basal edge of lateral tail-feathers pale olive; upper tail-coverts black, with dark olive edges; wing-feathers also more blackish than in *banksiana.*

Adult Female.—Not at all similar to that of *banksiana;* coloration of head sharply contrasting against that of back; forehead, crown and hind neck deep mouse-gray, centers of feathers darker, edges more grayish; ear-coverts, circumocular space, and upper cheeks grayish drab; back, rump, and upper tail-coverts olive-citrine; tail and edges of wing-feathers citrine; throat-feathers whitish with fuscous shaft-stripes, on lower throat with fuscous-buffy tips; breast-band narrow, in the middle buffy orange, on the sides more olive; feathers with dark shaft-stripes; lower breast, abdomen, and under tail-coverts lemon-chrome (R.IV).

Immature Male and Female (first-year plumage).—Similar to adult female, but throat pale lemon, not whitish; head olive, sides of head also washed with olive; greater wing-coverts and secondaries edged with rufous or rufous olive; tail-feathers pointed; bill not black, but pale horn-brown.

Tarsus, 24–26(24.8); culmen, from base 19.5–20, exposed 14–16 (in adult males).

	Wing	Tail
♂ ad.	85–87(85.8)	58–63(60.4)
♀ ad.	81–84(82.9)	57–60(59.0)

Range.—Vanikoro Island, Santa Cruz group.

This remarkable subspecies was discovered by Quoy and Gaimard on the expedition of the 'Astrolabe,' but was identified by them as the Australian *P. gutturalis*. Oustalet recognized the distinctness, but failed to emphasize the very distinct characters of the female. Although his description is not quite correct, there is no doubt that it was based on Vanikoro birds, as Mr. J. Berlioz assures me after an examination of the types. This subspecies differs from the Australian representatives, by the combination of a long bill and a short wing.

Pachycephala pectoralis utupuæ, new subspecies

TYPE.—No. 214308, Amer. Mus. Nat. Hist.; ♀ ad.; Utupua, Santa Cruz Islands; September 29, 1926; J. G. Correia.

ADULT MALE.—Similar to *vanikorensis*, but larger, bill longer; olive edges on wing-feathers and on tip of tail wider.

ADULT FEMALE.—Very unlike the *vanikorensis* female; coloration of head not sharply contrasting against that of back; forehead, crown and hind neck blackish gray with a fuscous-olive tinge; feathers with darker centers and lighter edges; scapulars and back rich brownish-olive, rump and upper tail-coverts purer olive; ear-coverts, circumocular space and upper cheeks drab; feathers of throat whitish, some with narrow grayish or cinnamon tips; breast-band wide, uniformly cinnamon; abdomen and under tail-coverts lemon-chrome; tail-feathers buffy- to olive-citrine; wing-coverts and wing-feathers edged with olive-cinnamon (isabella color, R.XXX).

IMMATURE MALE AND FEMALE (first-year plumage).—Similar to adult female, but bill brown, not black; yellow of abdomen paler and duller; throat sometimes tinged with yellowish; crown more strongly washed with brownish olive; greater wing-coverts and secondaries edged with rufous cinnamon; tail-feathers pointed.

Tarsus, 25–26; culmen, from base 20–21, exposed 14–17 (in adult males).

	WING	TAIL
♂ ad.	91–95(92.4)	62–67(64.5)
♀ ad.	88–90(89.1)	60–65(62.1)

RANGE.—Utupua Island, Santa Cruz Islands.

Like most species that tend to geographical variation, the thickheads are represented on Utupua by a very distinct form. The male is rather similar to the Vanikoro bird, while the female shows an apparent tendency toward the race that lives on Santa Cruz Island.

Pachycephala pectoralis ornata, new subspecies

TYPE.—No. 218022, Amer. Mus. Nat. Hist.; ♂ ad.; Santa Cruz, Santa Cruz Islands; February 24, 1927; R. H. Beck and F. P. Drowne.

ADULT MALE.—Similar to that of *utupuæ*, but all colors richer; black of breast-band deep and glossy; yellow of abdomen and under tail-coverts golden orange; white feathers on lower part of throat elongated and partly covering the breast-band, as in *mentalis;* upperside very different from that of *utupuæ*, not only the head, but

also back, scapulars, rump, upper tail-coverts and part of the wing being black; no signs of a yellow collar on hind neck; alula and primary-coverts entirely black; other wing-coverts and quills black with narrow olive edges; tail-feathers black, tips sometimes with narrow olive edge.

ADULT FEMALE.—Upperside fairly similar to the female of *utupuæ*, but back and edges of wing-feathers still more brownish, less olive; head and ear-coverts less grayish, more fuscous and drab; whole underside washed with cinnamon, only chin whitish; throat, lower cheeks and sides of throat pale cinnamon, feathers with darker tips; cinnamon breast-band indistinct, gradually merging into throat and abdomen; lower breast, upper abdomen and flanks cinnamon-yellow, middle of abdomen almost pure lemon; axillaries and under wing-coverts yellowish white; tail buffy citrine.

IMMATURE (first-year plumage).—Similar to adult female, but bill brownish, not black; tail-feathers pointed; crown duller brownish, less tinged with olive; male less cinnamon below, belly purer yellow, and throat more whitish; edges of wing-coverts and wing-feathers edged with (brownish) olive; female duller underneath, more strongly washed with cinnamon; wing-coverts and wing-feathers with rufous (olive) edges.

Tarsus, 26; culmen, from base 19–22(21), exposed 15–18 (in adult males).

		WING	TAIL
Santa Cruz, Santa Cruz Isls.	♂ ad.	94–97(95.7)	65–69(66.8)
	♀ ad.	89–94(91.6)	61–66(64.0)
Nepani, Swallow Isls.	♂ ad.	90–95(93.0)	65, 68
	♀ ad.	88, 93	64, 65
Lomlom, Reef Isls.	♂ ad.	94–98(96.2)	64–70(66.3)
	♀ ad.	90–93(91.5)	61–65(63.7)
Treasurers Isl., Duff Isls.	♂ ad.	93–97(94.3)	62–65(64.2)
	♀ ad.	87–91(88.7)	60–63(61.0)
Disappointment Isl; Duff Isls.	♂ ad.	92–97(94.2)	61–65(63.6)
	♀ ad.	89–94(90.5)	60–64(62.0)

RANGE.—Northern Santa Cruz group.

This handsome bird has a superficial resemblance to *P. p. melanonota* Hartert by its black back, but differs by the coloration of the underparts and by the olive edges of the wing-feathers. As a matter of fact it is more closely related to some of the Fijian species.

The birds from the Reef and Duff Islands agree with those from Santa Cruz, but the females, on the average, have the back purer olive and the head more grayish. There are no differences in size, as the table of measurements shows.

Pachycephala IN THE FIJI GROUP

In 1891, H. Seebohm published a paper "On the Fijian species of the genus *Pachycephala*,"[1] in which he gave a complete revision of all the forms known at that time, and in which he corrected the numerous

[1] Ibis, 1891, pp. 93–99.

mistakes made by earlier authors. No further progress has been made in the last forty years, and the arrangement proposed by Seebohm has been considered, up to the present time, as fundamentally correct.

The splendid collections of the Whitney South Sea Expedition, containing more than 300 skins from 18 islands, and our newer views concerning taxonomy and nomenclature make a complete revision necessary.

To tell in advance some of the results, it turns out that no island is inhabited by two forms: that is, all the forms replace one another. Furthermore, we have the same phenomenon as in the Solomon Islands,[1] that apparently two waves of immigrants have reached the islands. The birds on the large islands (Viti Levu and Vanua Levu), with the whole underside yellow and with two frontal spots, apparently represent the original stock. The birds with white throats and black breast-bands living on the outlying islands (Kandavu, Ngau, and Lau Archipelago), are similar to the thickheads from the New Hebrides and Australia, and apparently are more recent immigrants. On a score of islands (Ovalau, Taviuni, etc.), both waves met and formed hybrid populations, in the same way as the thickhead on Whitney Island in the Solomon Islands was developed. The perfect hybridization exhibited on these islands necessitates the inclusion of both groups in one species, in spite of the strong differences in color pattern.

Pachycephala pectoralis kandavensis Ramsay

Pachycephala kandavensis RAMSAY, 1876, Proc. Linn. Soc. N.S.W., I, p. 65, Kandavu, Fiji Islands.

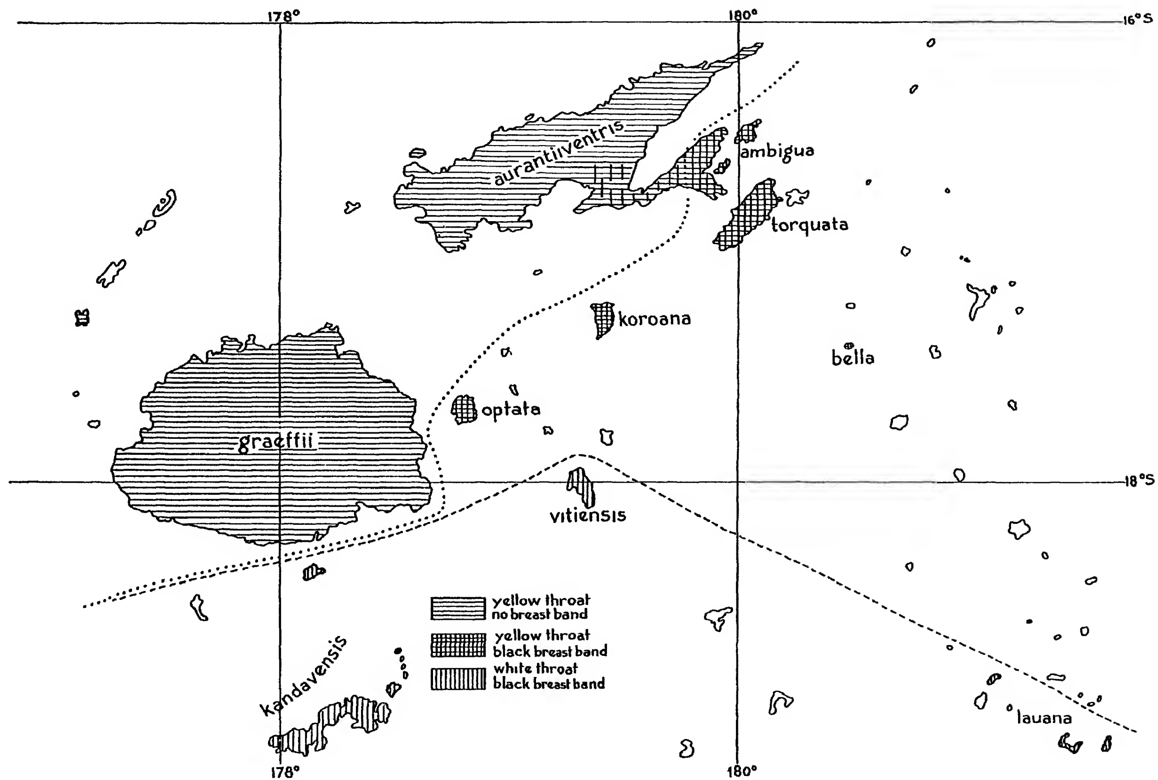
ADULT MALE.—Similar to the males of the *chlorura*-group, but bill shorter; green of upperside darker, duller and less olive, about light yellowish-olive (R.XXX); yellow of underside also less bright; black breast-band much narrower.

ADULT FEMALE.—Somewhat similar to that of *atrata*, but back purer olive; yellow on underside more reduced. Crown hair-brown, lighter and more cinnamon on forehead (Drab, R.XLVI); superciliary, ear-coverts, and sides of head deep cinnamon; back, tail, and edges of primaries dark buffy-olive (R.XXX); upper tail-coverts and edges of secondaries of the same color, but mixed with cinnamon; chin whitish, upper throat light pinkish-cinnamon, lower throat slightly darker; breast, abdomen and flanks between cinnamon-buff (R.XXIX) and honey yellow (R.XXX), in some specimens more cinnamon, in some less so; under tail-coverts cinnamon-yellow; under wing-coverts and axillaries pale buff.

IMMATURE MALE.—Similar to adult female, but[2] underside lighter, slightly washed with olive; under tail-coverts more strongly washed with yellow; upperside more olive, especially on head and tail.

---

[1]See Amer. Mus Novit., No. 522, pp. 5, 7–10.
[2]The characters common to all the forms of young *Pachycephala pectoralis* (color of bill and wing-coverts, structure of body-plumage, shape of first primary and of tail) have been mentioned on p. 4. Here I record only the peculiarities of this subspecies.



Geographical Variation of *Pachycephala pectoralis* on the Fiji Islands.

The map illustrates the extreme localization of the races and shows the distribution of the two main groups and of the intermediate forms. The islands without shading were also visited by the Whitney Expedition, but no thickheads were found there.

IMMATURE FEMALE.—In coloration about intermediate between adult female and immature male.

JUVENAL.—The whole body plumage is uniform rufous. Most of the immature specimens still have the remains of this soft nestling plumage.

Tarsus, 23–25 (23.5); culmen, from base 17–18 (17.3), exposed 11–14.

		WING	TAIL
Kandavu group	♂ ad.	87–92(89.8)	65–68(65.9)
	♀ ad.	85–88(86.8)	63–66(64.4)
Mbengha Island	♂ ad.	88–92(89.5)	65–68(66.5)
	♀ ad.	88, 88	65, 65

RANGE.—Kandavu group (Vanua kula, Kandavu, and Ono) and Mbengha Island, Fiji Islands.

The birds from Mbengha Island agree very well with those from Kandavu, although Viti Levu is much closer. The only difference that I can see is that the females have the crown slightly more grayish.

Pachycephala pectoralis lauana, new subspecies

TYPE.—No. 252695, Amer. Mus. Nat. Hist.; ♂ ad.; Ongea Levu Island, Lau Archipelago, Fiji Islands; July 28, 1924; R. H. Beck and J. G. Correia.

ADULT MALE.—Upperside similar to *vitiensis*, but back more blackish; underside similar to *kandavensis*, but breast-band wider. Head and hind neck glossy black, yellow nuchal collar very narrow, sometimes interrupted; back dusky olive, centers of feathers on fore-back blackish; rump lighter (dark greenish-olive); upper tail-coverts black with broad dark-olive tips; tail-feathers black with grayish tips; throat white, base of all feathers blackish; breast-band narrow, but wider than that of *kandavensis;* breast, abdomen and under tail-coverts lemon to lemon-chrome; axillaries white, with gray bases and lemon tips; under wing-coverts black and white; carpal edge black and pale lemon; wing as in *vitiensis*, but olive edges on wing-coverts and grayish-olive edges on secondaries narrower.

ADULT FEMALE.—Similar to that of *kandavensis*, but larger, with less lipochrome; underside decidedly paler and the yellow tinge of the pale cinnamon colors almost entirely restricted to the under tail-coverts; forehead and crown darker and more grayish; back and tail duller, more brownish and less olive; edges of wing-feathers rufous cinnamon with very little or no olive tinge.

IMMATURE.—With the usual immature characters on bill, wing and tail; otherwise like the adult female; young males have the back richer olive than young females.

Tarsus, 27; culmen, from base 19–20 (19.7), exposed 14–16.

		WING	TAIL
Ongea Levu	♂ ad.	93–98(95.8)	63–67(64.8)
	♀ ad.	92–96(93.9)	63–67(65.0)
Fulanga	♂ ad.	98, 100	68, 68
Wangava	♂ ad.	96–100(97.7)	66–71(68.1)
	♀ ad.	90–95(92.7)	61–66

RANGE.—Southern Lau Archipelago (Ongea Levu, Fulanga and, Wangava).

This interesting melanistic form seems to be restricted to the abovementioned three islands. The Whitney Expedition has also collected on all the other islands of the Lau group and did not encounter this species.

The two males from Fulanga are rather more blackish on the back than the other birds, but as the island lies between Ongea Levu and Wangava, I consider the difference as not sufficient for separation.

Pachycephala pectoralis vitiensis Gray

Pachycephala vitiensis G. R. Gray, 1859, 'Cat. Birds Trop. Islands,' p. 20, Feejee Islands (island of Ngau).

Adult Male.—Underside similar to that of *ornata*, the black breast-band being broad, and breast and abdomen of a rich, golden yellow; black of head intense and almost glossy; scapulars and back dark greenish-olive, feathers on upper back with black shafts; primaries edged pale olive-gray, secondaries with dull grayish-olive; tail black, tips of tail feathers lighter (pale olive-gray).

Adult Female.—In general style of coloration similar to the female of *kandavensis*, but all colors much richer; whole underside ochraceous orange (R.XV), on throat duller (more like pinkish-cinnamon, R.XXIX), on the middle of the abdomen lighter (more like ochraceous buff, R.XV); forehead, crown and hind neck dark mouse-gray; lores blackish, superciliary fuscous; ear-coverts umber-brown; back brownish-olive, richer olive toward the rump; tail-feathers dull brownish-gray tinged and edged with olive, paler on tips; wing-feathers edged with olive, cinnamon-olive or rust color.

Immature Male (II. Phase).—Similar to adult female, but underside lighter, abdomen more washed with yellow; upperside less washed with brownish; head purer gray (partly blackish), back purer olive; bill black, wing-coverts edged with olive; tail feathers not pointed.

Immature Male (I. Phase) and Female.—Similar to adult female, but on bill, wing, and tail with the characters of immaturity; no contrast between crown and back, the crown being suffused with olive; ear-coverts brownish; edges of wing-coverts and wing-feathers washed with brownish.

Tarsus, 25–26 (25.7); culmen, from base 19, exposed 15 (in adult males).

	Wing	Tail
9 ♂ ad.	89–93(91.1)	59–65(61.7)
9 ♀ ad.	86–89(88.1)	58–61(59.3)

Range.—Ngau Island, Fiji Islands.

The types of this subspecies were apparently unique before the activity of the Whitney Expedition. Seebohm states (Ibis, 1891, p. 99) that the typical specimens were collected by Dr. Rayner during the cruise of the 'Herald' (1845–1851), but so far as I can make out the 'Herald' never visited the Fiji Islands; neither was Dr. Rayner one of the members of that expedition, so I suppose Seebohm must have made a mistake.

These three subspecies (*kandavensis*, *lauana*, and *vitiensis*) form the group of the white-throated thickheads in the Fiji Islands. The following five subspecies form another group which is intermediate between the white-throated birds with a black breast, and those with uniform yellow underparts. All these forms have a yellow throat and a black breast-band. (See map, p. 11.)

Pachycephala pectoralis bella, new subspecies

TYPE.—No. 224036, Amer. Mus. Nat. Hist.; ♂ ad.; Vatu vara Island; October 2, 1924; R. H. Beck.

ADULT MALE.—Head black, large supraloral spots orange-yellow; yellow nuchal collar narrow, but uninterrupted; back and scapulars olive-green; upper tail-coverts black with indistinct yellowish-olive edges; tail-feathers black, with a yellowish-olive tip; throat light golden-orange, on chin with a few whitish feathers; black breast-band narrow; breast, abdomen, flanks and under tail-coverts brownish golden-orange; axillaries and under wing-coverts white with lemon tips; carpal edge lemon; alula and primary-coverts black; wing-coverts edged with olive, secondaries with grayish olive and primaries with pale gray.

ADULT FEMALE.—Somewhat similar to that of *kandavensis*, but lacking the olive tones on the upperside almost completely except on tail. Crown and hind neck dark rufous-brown (between bister, R.XXIX, and mummy brown, R.XV), back lighter and less rufous, almost without any traces of olive, brighter on rump; ear-coverts tawny (R.XV); underparts pinkish cinnamon-buff (R.XXIX), lighter on chin and on the middle of the abdomen, darker on the breast; under tail-coverts washed with pale lemon; wings fuscous, wing-coverts and secondaries edged with russet brown.

There are some "male" feathers in both females. One bird (No. 252740) has a few yellow feathers on the throat and two blackish feathers on the hind neck. The other specimen (No. 224038) has the supraloral region on the right side extensively yellow, numerous black or blackish feathers above the right eye, and many yellow feathers on breast and flanks; the edges to the wing-coverts and secondaries are also more grayish olive, than russet brown. Both specimens are sexed as nesting females.

Tarsus, 25; culmen, from base 18, exposed 13 (in the type).

	WING	TAIL
1 ♂ ad. (type)	94	61
2 ♀ ad.	91, 92	62, 66

RANGE.—Vatu vara Island, Fiji Islands.

More material is required before it can be definitely stated whether this marked subspecies is due to hybridization or else acquired its intermediate characters by convergency. The presence of the yellow supraloral spots speaks for a close relationship with the *aurantiiventris-græffii* group.

Pachycephala pectoralis koroana, new subspecies

TYPE.—No. 252809, Amer. Mus. Nat. Hist.; ♂ ad.; Koro Island, Fiji Islands; December 20, 1924; R. H. Beck.

ADULT MALE.—Similar to *torquata* Layard, with the tail blackish, throat yellow, and back dark olive; but black breast-band wider; yellow of underside deeper orange, on lower flanks and under tail-coverts almost ochraceous; whitish axillaries and under wing-coverts more strongly washed with yellow; color of back very variable, in some specimens (as No. 252810) very blackish with only the tips of the feathers olive, in other birds dark citrine (extreme: No. 252808); the olive tones always more mixed with brownish than in *torquata*, which shows best on the upper tail-coverts and the edges of the wing-feathers.

ADULT FEMALE.—Fairly similar to the female of *torquata* and indistinguishable from some specimens of the Taviuni race; only slight individual variation. Not much difference between the color of head and back; head dark grayish-brown, back richer and more warmly colored, sometimes more rufous, sometimes more olive; upper tail-coverts dark chestnut or fuscous olive; underside ochraceous cinnamon, more rufous on breast and flanks, throat and middle of abdomen lighter; tail blackish fuscous with brownish olive or rufous edges, and paler tip, wing-coverts and wing-feathers with rufous or cinnamon-rufous edges; bill black; two of seven specimens have a few yellow feathers on breast and abdomen.

IMMATURE MALE (II. Phase; 3 specimens).—Similar to adult female, but underneath lighter, more ochraceous, less rufous; back more washed with olive, less with rufous brown; some of the feathers of the crown partly blackish; wing and tail of the shape of an adult female; all three birds are molting on throat and wing-coverts into the adult plumage.

IMMATURE MALE (I. Phase) AND FEMALE.—Similar to the adult female, but upperparts duller, underparts lighter; most specimens still have large patches of the soft, uniformly rufous, nestling plumage; signs of immaturity on bill, wings and tail.

Tarsus, 26–27; culmen, from base 19, exposed 13–14 (in adult males).

	WING	TAIL
6 ♂ ad.	92–97(95 2)	67–71(68.7)
6 ♀ ad.	91–94(92 2)	65–68(66.3)

RANGE.—Koro Island, Fiji Islands.

This form, somewhat intermediate in its characters between the *vitiensis* group and the *græffii* group, shows very little individual variation and can therefore not be considered a hybrid population. In the characters of both sexes, although clearly belonging to a distinct stock, this subspecies (as well as *torquata* and *optata*) shows more affinity to *vitiensis* than to *aurantiiventris*.

Pachycephala pectoralis torquata Layard

Pachycephala torquata LAYARD, 1875, Proc. Zool. Soc. London, p. 150, Taviuni Island, Fiji Islands [also Ibis, 1876, p. 146].

ADULT MALE.—Similar to that of *koroana* (see above, where the differences have been described); differs from *aurantiiventris* Seebohm by having forehead and lores

entirely black, the black breast-band well developed and not interrupted in the middle, the yellow band across the hind neck more distinct, and the gray or olive-gray edges of the wing-feathers more washed with brownish.

Adult Female.—Extremely variable. Some are indistinguishable from the ventrally uniform cinnamon females of *koroana* (see p. 15), while others approach the color pattern of *aurantiiventris* females. The specimen most extremely developed in this direction is No. 252770, which may be described as follows: head dusky gray, feathers with olive-gray edges which are lighter and more olive-cinnamon on the forehead; back dull olive-gray, more citrine gray toward the rump; upper tail-coverts cinnamon-olive; tail-feathers fuscous with dull (grayish) olive edges; edges of primaries drab, edges of secondaries dull cinnamon, of wing-coverts olive-cinnamon; upper throat whitish, lower throat buffy, feathers with dark grayish shaft-streaks; lower cheeks buff mixed with pale yellow; breast grayish cinnamon-buff, abdomen and flanks pale cinnamon-buff, whitish in the middle of the belly; under tail-coverts cinnamon-buff with a yellow wash; feathers of breast, upper abdomen, and upper flanks with indistinct grayish shaft-stripes; this specimen combines the characters of the females of *koroana* and *aurantiiventris*.

Immature Female.—Very variable as adult female, with the usual signs of immaturity on bill, wings, and tail.

Tarsus, 27–27.5; culmen, from base 19–20, exposed 13–14 (in adult males).

	Wing	Tail
10 ♂ ad.	93–98(95.6)	63–71(66.8)
8 ♀ ad.	90–94(91.9)	63–68(65.2)

Range.—Taviuni Island, Fiji Islands.

The extreme individual variation of the females points to an admixture of *aurantiiventris* or *ambigua* blood.

Pachycephala pectoralis ambigua, new subspecies

Type.—No. 252825, Amer. Mus. Nat. Hist.; ♂ ad.; Rambi Island, Fiji Islands; December 4, 1924; R. H. Beck and J. G. Correia.

Adult Male.—Similar to that of *torquata* but width of black breast-band in most specimens much reduced (in fourteen specimens from Rambi Island, three have the breast-band wide, three narrow, five very narrow, and three interrupted; in three males from Kio Island, one has the breast-band narrow and two very narrow, while, in ten males from Taviuni, seven have the breast-band wide, two narrow, and one very narrow); the head is entirely black in twelve specimens, but two birds (Nos. 252857 and 252824) have a few yellow feathers in the supraloral region; the chin in many specimens, and the upper throat in a few specimens are whitish; the lower part of the outer edge of the primaries is purer gray than in *torquata;* the back is more citrine and less mixed with blackish.

Adult Female.—Very variable, but similar to the females of *aurantiiventris*. Although undoubtedly mature, all the five adult females from Rambi and two adult females from Kio, have characters that in other races indicate immaturity. The bills are brown instead of black and the wing-coverts have rufous edges, but the shape of the tail and the color of the primary-coverts, as compared with typical immature birds from the same islands, prove their maturity. In all seven specimens (collected

December, 1924) the gonads are indicated as small. Each of the seven specimens is somewhat different, but all except one (No. 252673, which belongs to the brownish phase) have the streaking of the underside more pronounced than the females of *torquata*. Five specimens have under tail-coverts and thighs washed with yellow; three specimens have the lower cheeks distinctly, two indistinctly washed with yellow; the upper surface shows every intergradation between rufous earth-brown and dull olive-gray; the wing-coverts and secondaries are edged with rufous or rufous cinnamon, the primaries with cinnamon to grayish drab; the ground color of the underside varies from buffy cinnamon to grayish white, on the breast sometimes with an olive tinge. All the specimens show distinct brownish to grayish shaft-streaks on throat and breast and a few obsolete ones on the lower abdomen and the flanks; the breast is darker, washed with grayish or drab; concerning the coloration of the upperside, two specimens belong to the olive-gray type, one is intermediate and four more rufous brown; concerning the underside, four specimens belong to the grayish type, one is intermediate and two represent the buffy cinnamon phase.

IMMATURE.—Similar to adult female, but still more variable; males usually characterized by the stronger olive tinge of head, back, and tail.

Tarsus, 25–27 (25.8); culmen, from base 19, exposed 13–14 (in adult males).

	WING	TAIL
18 ♂ ad.	90–95	64–68
8 ♀ ad.	89–92	64–68

All the specimens (collected December 3–8, 1924) are badly molting.

RANGE.—Rambi Island, Kio Island, and Thakaundrove Peninsula of Vanua Levu.

This subspecies, the males of which resemble those of *torquata* and the females those of *aurantiiventris*, seems not to be restricted to the islands of Rambi and Kio, but also to have settled on the southeastern peninsula of Vanua Levu. A male collected there by the Whitney Expedition has a well-developed breast-band. How far on Vanua Levu the influence of *ambigua* reaches is not yet certain. A series from Savu-savu Bay (south coast) still shows traces of the black breast-band, while birds collected on the western and northern coast of Vanua Levu are typical *aurantiiventris*.

Pachycephala pectoralis optata Hartlaub

Pachycephala (?) *optata* HARTLAUB, 1866, Ibis, p. 172, Ovalau Island.

Pachycephala neglecta LAYARD, 1879, Proc. Zool. Soc. London, p. 147, Ovalau Island.

?*Pachycephala intermedia* LAYARD, 1876, Ibis, p. 154, Tai Levu, northeast Viti Levu.

ADULT MALE.—Similar to *ambigua*, but back more olive, less brownish citrine; in two of five males there are a few yellow feathers in the supraloral region; underside lemon-chrome, not golden orange; chin and upper throat sometimes whitish; of five specimens, the breast-band is complete in one, narrowly interrupted in two, and

broadly interrupted in two; tail black, with pale grayish-olive tips; edges of primaries dull grayish or drab, of secondaries olive, not grayish-olive; edges of wing-coverts olive with hardly any yellowish tinge.

ADULT FEMALE.—Very variable. Each of the four adult females represented in the collection looks as if it belonged to a different subspecies: one (No. 252797) belongs to the rufous phase: one (No. 252915) is entirely cinnamon underneath; two other birds (Nos. 252914 and 224031) are buffy and yellowish-white on the middle of the abdomen, while the sides of the throat, the breast, the flanks, and the under tail-coverts are more or less strongly washed with cinnamon. The two specimens first mentioned are uniformly colored underneath, while the two other birds have a mottled appearance underneath. No. 252914 has gray shaft-stripes on throat, breast, and flanks, and No. 224031 has narrow rufous bars across the tips of the feathers on throat and breast; back and head are dark olive, more or less mixed with brownish; the edges of wing-feathers and wing-coverts are rufous; the bill is black in all four specimens.

IMMATURE MALE.—There are three immature males in the collection that, except for the characters of immaturity, are fairly similar to the adult females. Two of the specimens belong to the rufous-brown phase, and one to the grayish-olive.

Tarsus, 26–27; culmen, from base 19–20, exposed 13–14 (in adult males).

	WING	TAIL
6 ♂ ad.	91–94(92.7)	65–70(67.0)
4 ♀ ad.	92, 93	63, 64, 66

RANGE.—Ovalau Island, Fiji Islands.

Hartlaub described the species from a single female, and Layard redescribed the bird, apparently not being able to make out Hartlaub's description. This subspecies forms the transition from *koroana* to *græffii*, as do *torquata* and *ambigua* between *koroana* and *aurantiiventris*. The high individual variation is evidence of a biphyletic origin of the form.

This concludes the group of forms in which the males have a yellow throat and a black breast-band, while the females show considerable variation. There remain two forms to be discussed, *græffii* and *aurantiiventris*, constituting a group in which the males have the underparts entirely yellow, the yellow frontal patches always present, and in which the females have always a conspicuous pattern of spotting or striping.

Pachycephala pectoralis græffii Hartlaub

Pachycephala græffii HARTLAUB, 1866, Ibis, p. 172, Viti Levu, Fiji Islands.

?*Pachycephala intermedia* LAYARD, 1876, Ibis, p. 154, Tai Levu, northeast Viti Levu.

ADULT MALE.—Crown, hind neck, lores, upper cheeks, ear-coverts and sides of neck black; two supraloral spots or whole forehead lemon-chrome; back dark olive-green, yellowish-olive collar in hind-neck only indicated; upper tail-coverts olive; tail black, tips of central tail-feathers blackish, edge of inner web of the outer tail-

feathers whitish; entire underside yellow (lemon-chrome), lighter, sometimes almost whitish on chin; richer, more orange on breast and upper abdomen; black patch on both sides of upper breast only indicated; flanks somewhat washed with grayish olive; wing-feathers blackish; edges of primaries pale neutral gray, of secondaries and primary-coverts grayish olive; edges of wing-coverts yellowish olive, the tips sometimes pale yellow.

ADULT FEMALE.—Very variable and practically indistinguishable from the females of *aurantiiventris*. Two of nine specimens have the upper side of the chestnut phase, two more or less olive, but five are intermediate. The lower cheeks, the supraloral and superciliary region, and the circumocular feathers are always more or less washed with yellow; thighs and under tail-coverts are in most specimens slightly washed with yellow; the coloration of the underside shows less individual variation than the upperside, all the birds showing the same pattern. Lower mandible never entirely black.

IMMATURE MALE.—Similar to adult female, but throat and breast often washed with yellow; yellow marks on head more pronounced; back and tail on the average more olive; tail strongly pointed.

IMMATURE FEMALE.—Except for a slight rufous wash on the underside and the shape of tail and primary-coverts, it is indistinguishable from adult females.

Tarsus, 26–28 (27); culmen, from base 18.5–19.5, exposed 13–14 (in adult males).

		WING	TAIL
Viti Levu	13 ♂ ad.	93–101(95.8)	67–74(70.6)
	9 ♀ ad.	91–95(92.8)	67–71(69.0)
Waia	8 ♂ ad.	91–96(93.5)	65–72(68.6)

RANGE.—Viti Levu and Waia, Fiji Islands.

Specimens from Waia Island cannot be separated subspecifically, although the males are, on the average, paler yellow underneath and have less whitish on the tips of the outer tail-feathers, and the females are usually purer gray underneath, more olive above and with more yellow on the under tail-coverts. However, I do not regard these characters as sufficient for a subspecific separation, since the difference is widely bridged by individual variation.

Layard described in 1876 a single male with complete black breast-band under the name *intermedia*. The type locality is Tai Levu, a cape of Viti Levu, opposite to Ovalau. The type specimen was apparently lost later on, and the question remains: what form occurs on the Fijian mainland opposite Ovalau? Does the island form *optata* occupy part of the mainland, as does *ambigua* on Vanua Levu, or was the type of *intermedia* an exceptional extreme? More specimens (including females) have to be collected before this question can be answered. All the specimens collected on Viti Levu by the Whitney Expedition are typical *græffii*.

P. p. græffii is very closely related to *P. p. aurantiiventris*, but differs in the male sex by the much lighter coloration of the underparts.

Pachycephala pectoralis aurantiiventris Seebohm

Pachycephala aurantiiventris SEEBOHM, 1891, Ibis, p. 96, Vanua Levu Island, Fiji Islands.

ADULT MALE.—Head black with two yellow supraloral spots which sometimes combine to form a broad frontal band; back olive, more greenish, less citrine than in *ambigua*; tail and wing as in *ambigua*, but edges of wing-coverts still more yellowish, tail-feathers black with pale olive-gray tips; primaries with pale neutral gray edges, secondaries with olive-gray edges; yellow nuchal collar reduced; underside golden orange, on the sides of the breast with remains of the black band of the related forms; in fifteen males, twelve have just a small triangular black patch on both sides of the upper breast; in three specimens it forms a breast-band broadly interrupted in the middle of the breast.

ADULT FEMALE.—Only two specimens were collected on Vanua Levu and one on Yanganga; thus, not much can be said about the individual variation. All three fall within the range of variation of the females of *ambigua*, as described above.

Crown, back, scapulars, and rump dark brown (mummy brown, R.XV), forehead lighter and somewhat washed with olive, nuchal collar sometimes indicated; lores darker, fuscous; ear-coverts lighter, lower cheeks and under tail-coverts slightly washed with yellow, ground color of underparts a pale buffy gray, darker on the breast, lighter, almost whitish in the middle of the throat and abdomen; feathers of throat and breast with shaft-streaks and grayish cross-bars, on abdomen and flanks only with pale, but broad, shaft-streaks; axillaries whitish or pale gray, under wing-coverts gray with whitish or pale yellow edges; wing and tail dark brown; edges of wing-coverts and secondaries russet; edges of primaries lighter and more grayish.

IMMATURE MALE AND FEMALE.—Similar to the adult female, but with the usual signs of immaturity. Immature males often strongly washed with olive on the upperside, and with yellow on the cheeks and circumocular region.

Tarsus, 25–26; culmen, from base 18–19, exposed 13–14 (in adult males).

	WING	TAIL
14 ♂ ad.	89–94(91.3)	63–70(66 2)
3 ♀ ad.	86, 86, 87	63, 64

RANGE.—Yanganga Island and Vanua Levu (except southeastern peninsula).

Birds collected on Yanganga Island, on the north coast (opposite Mathuata) and on the west coast (Mbuabay), are typical. However, from five males collected on Savu-savu Bay (south coast), three have the breast-band almost complete and also have the loral spots only small. It is here that the intergradation with *ambigua* takes place.

Pachycephala IN CENTRAL POLYNESIA

In Polynesia east of the Fiji Islands, only two species of thickheads live. Both are obvious representatives of *Pachycephala pectoralis*, but both have acquired such distinct characters that it would be hazardous to include them in that species. Furthermore, the characters of these

species are linked together neither by the extremes of individual variation nor by hybridization as we find it in the Solomon Islands and in the Fiji group.

Pachycephala melanops (Pucheran)

Eopsaltria melanops PUCHERAN, 1853, 'Voy. Pôle Sud,' Zool. III, p. 56 (Atlas, Pl. v, fig. 2), Vavao, Tonga Islands.

?Pachycephala jacquinoti BONAPARTE, 1851, 'Consp. Gen. Av.,' I, p 329 (*nomen nudum*).

ADULT MALE.—Head, sides of head, and throat black; rest of underside and nuchal collar rich yellow; back, scapulars, and edges of wing-coverts and secondaries bright yellowish olive (between pyrite yellow and citrine, R.IV); rump and upper tail-coverts yellowish olive; tail black, tips and bases of tail-feathers pale yellow; wing-feathers blackish, edges of primaries grayish or grayish olive.

ADULT FEMALE.—Crown gray (deep olive-gray, R.LI), on forehead, superciliary and postocular region washed with buff; back, scapulars, rump, and upper tail-coverts dull citrine, nuchal band yellowish citrine; ear-coverts cinnamon; upper throat white, tips of many feathers blackish, lower throat whitish, with a strong wash of cinnamon (buff) rest of the underside pale yellow (empire yellow, R.IV); tail-feathers fuscous citrine with pale yellow tips; wing-feathers fuscous with broad dull citrine edges on wing-coverts and secondaries, sometimes washed with cinnamon; edges of primaries more or less grayish.

IMMATURE MALE (II. Phase).—Intermediate in plumage between immature male (I. Phase) and adult male. Bill black, feathers on head partly blackish; back and tail brighter olive; belly brighter yellow; edges of wing-coverts olive.

IMMATURE MALE (I. Phase) AND FEMALE.—Similar to adult female, but bill pale brown; wing (especially coverts and secondaries) strongly mixed with russet; tail-feathers pointed and tips cinnamon (yellow); yellow of underparts much paler; in many specimens remains of the soft cinnamon-colored nestling plumage are still persisting; the crown seems to be the place where this plumage persists longest.

Tarsus, 26–27; culmen, from base 20–22, exposed 15–16 (in adult males).

		WING	TAIL
Vavau group	14 ♂ ad.	101–106(103.9)	68–73(71 0)
	13 ♀ ad.	95– 99(96.8)	66–69(67.5)
Late	4 ♂ ad.	102–103(102.5)	69–71(70.0)
	1 ♀ ad.	99	69

RANGE.—Vavau group (Vavau, Kapa, Ava, and Euakava) and Late, Tonga Islands.

This species is very rare in collections. The males somewhat approach *P. p. lauana* except for the entirely black throat, and the females, also somewhat similar to those of *lauana*, are surprisingly like those of *utupuæ*. This is another instance of how independently the same characters can crop out in far distant representatives of the species *Pachycephala pectoralis*.

Pachycephala flavifrons (Peale)

Eopsaltria flavifrons Peale, 1848, 'U. S. Explor. Exped.,' Birds, p. 96, Upolu, Samoa.

Eopsaltria icteroides Peale, ibidem, p. 97, Samoa.

Eopsaltria albifrons Peale, ibidem, p. 97, Samoa.

Pachycephala hombroni Bonaparte, 1851, 'Consp. Av.,' I, p. 329 (*nomen nudum*).

Eopsaltria diademata Pucheran, 1853, 'Voy. Pôle Sud.,' Zool. III, p. 55, Samoa.

Adult Male.—There are three color phases in this species of which I describe the most frequent one ("*icteroides*"). Upperside olivaceous black, more grayish on the crown, more olive on the rump; forehead and supraloral region yellow; lores, cheeks, and ear-coverts blackish; wings and tail black; wing-coverts edged with blackish olive, wing-feathers edged with drab or dark grayish; feathers of throat with dark gray bases and yellowish tips; breast, flanks, abdomen, and under tail-coverts yellow (rich lemon-chrome); axillaries and under wing-coverts white with a slight yellow tinge; tail-feathers sometimes with narrow cinnamon tips.

"*P. flavifrons*" phase similar, but tips of feathers on throat white, instead of yellow.

"*P. albifrons*" phase similar, but tips of feathers on throat and forehead white.

Adult Female.—Similar to adult male, except in the coloration of forehead and throat; no sharply outlined yellow spot on forehead, but forehead and supraloral region washed with grayish yellow; fore part of crown washed with yellowish olive; throat grayish, feathers with narrow yellow edges. The three color phases occur also in the females: some specimens have the throat, and some the throat and forehead without a yellowish wash.

Immature Male and Female.—Similar to adult female, but mandible not black, tail pointed, yellow of underside paler, and wing-coverts with rufous edges; in some specimens remains of the rufous nestling plumages persist on throat, flanks, and under tail-coverts; on the crown the feathers of the nestling plumage are dusky with dull olive or olive-brown edges.

The following table illustrates the proportions of the three color phases in the Whitney material.

	Upolu		Savaii	
"*albifrons*"	1 ♂ ad.		2 ♂ ad.	4 ♀ ad.
"*flavifrons*"	1 ♂ ad.	2 ♀ ad.	4 ♂ ad.	
"*icteroides*"	9 ♂ ad.	8 ♀ ad.	8 ♂ ad.	9 ♀ ad.

"*albifrons*" throat white, forehead white
"*flavifrons*" throat white, forehead yellow
"*icteroides*" throat yellow, forehead yellow

Tarsus, 24–25; culmen, from base 18.5–19, exposed 12–13 (in adult males).

		Wing	Tail
Upolu	11 ♂ ad.	86–89(87.6)	58–62(60.6)
	10 ♀ ad.	81–86(83.8)	51–59(56.5)
Savaii	14 ♂ ad.	84–90(86.8)	55–62(58.5)
	13 ♀ ad.	82–85(83.5)	54–60(56.2)

Range.—Upolu and Savaii, Samoa Islands.

The birds from Savaii are indistinguishable from those from Upolu.

The individual variation in this species is highly interesting, as three distinct color phases exist. Judging from my figures, the presence of yellow on forehead and on throat is a dominant character. The material at hand is, however, not sufficient to draw any further conclusions. The ratio, 34:7:7, of my series does not come close to any of the expected ratios, of which 12:3:1 or 9:3:4 appear to be the most probable.

The most interesting feature is that "white throat" or "yellow throat" appear here as alternate characters in the same population. The yellow coloration of the throat has been used as a favorite argument against the inclusion of many Solomon Islands thickheads (*orioloides* group) and Fiji Islands thickheads (*græffii* group) in the species *Pachycephala pectoralis*. Here, in Samoa, in a representative species of thickheads, this character is of no systematic value at all.

AMERICAN MUSEUM NOVITATES

Number 532 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | June 2, 1932

59 79 S

THE VALIDITY OF *SIREN INTERMEDIA* LECONTE, WITH OBSERVATIONS ON ITS LIFE HISTORY

BY G. K. NOBLE AND B. C. MARSHALL

While recently studying the development of *Siren* with material received from Florida and Arkansas we have found that there are two forms confused under the name *Siren lacertina* Linné. These forms differ from one another in the size of the egg-capsules, the coloration of the young, the size at sexual maturity, and the average number of costal grooves. Since the two species occur together throughout most of their ranges we consider that they represent distinct species and not races. The case is comparable to that exhibited by certain southern species of *Desmognathus*, but differs in that the adults of the small species are much more difficult to distinguish from the immatures of the large one. The evidence for the validity of the small species will, therefore, be considered in detail.

First the question arises as to what name to apply to the small species. In 1826 LeConte described *Siren intermedia*, distinguishing it from *S. lacertina* only by its smaller size and reduced gills. It is now known that the latter character is of no value, since *S. lacertina* immersed in irritating fluids undergoes the same regression of the gills (Noble, 1924). LeConte made use of none of the diagnostic characters of our small species in defining *S. intermedia*. He did state that the greatest length of his species was twelve inches but added that he had not seen an "oviferous female." Since LeConte did not designate a type specimen, it is impossible to determine whether he was describing the adults of the small species of *Siren* which we are defining or whether his description was based solely on the young of the large species. Linnæus apparently gave the name *lacertina* to the large species, for in an early description (1767) he states that the species measures a foot and a half in length. Moreover, Ellis (1766), who supplied Linnæus with his specimens, has figured a *Siren* that agrees with the large species in size. We have not been able to locate any of the material that LeConte had before him when he drew up his description of *intermedia*. Even if a specimen should be found and its specific status determined, this will not exclude the possibility that LeConte had other material at hand, possibly the

other species as well, when the description was written. Under these circumstances it seems most advisable for us to define the two species of *Siren* and to restrict LeConte's name *intermedia* to our small species.

Siren intermedia LeConte

Siren intermedia LeConte, 1826, Ann. Lyc. Nat Hist., New York, II, pp. 133–134, Pl. i. J. A. Smith, *op. cit.*, pp. 261–263. Holbrook, 1842, 'N. A. Herp.,' V, p. 107, Pl. xxxv.

Siren lacertina Cope (not of Linné), 1889, 'Batr. N. Amer.,' Bull. U. S. N. M., No. 34, p. 226 (part).

Diagnosis.—A dwarf species, the females reaching sexual maturity when only 195 to 272 millimeters in total length, costal grooves ranging from 31 to 35 in number, rarely reaching 36, while in *lacertina* they range from 36 to 39 in number but are usually either 37 or 38; egg with the same number of capsules as *lacertina* but the outer capsule much narrower; immature specimens with a broader head than the

Fig. 1.—Eggs of *Siren intermedia* LeConte, preserved in formalin a few days before hatching.

The opaque outer capsule is characteristic of the eggs of the Sirenidæ

immature *lacertina* and differently colored; the yellow band across the tip of the snout much broader than in *lacertina;* another yellow bar across the occiput; a narrow longitudinal stripe of yellow on the upper surface of the head mesial to each eye; older individuals uniform gray or with some indication of a pale streak on lips or side of body.

Range.—Southern United States and northern Mexico, as far north as Arkansas and Illinois in the west and Virginia in the east.

Discussion of Specific Status

Cope (1889, p. 228) in his description of *lacertina* states:

The transverse grooves are distinct on the sides and nearly meet on the belly, but are not distinct on the back. They vary from thirty-one to thirty-seven in

number. The larger specimens generally have thirty-six and thirty-seven grooves, while smaller ones frequently have only thirty-one and thirty-two. The specimens with thirty-three, thirty-four and thirty-five are of medium size; but a full-sized one from Georgia (No. 4535) has thirty-two, and a small one from South Carolina (No. 10514) has thirty-four. It was on specimens presenting the characters of the smaller individuals above mentioned that the *S. intermedia* of LeConte was proposed. I can not distinguish it from the ordinary form.

LeConte in his original description makes no mention of costal grooves and he indicates only a few in his figure of *S. intermedia*. However, he does emphasize the small size of the species. We have been able to compare a series of very young *Siren* collected at Gainesville, Florida, with a series hatched from eggs collected near Imboden, Arkansas. So far as we have been able to determine, only the large form of *Siren* occurs in the former locality and only the smaller in the latter. In a series (A. M. N. H. Nos. 32135–32149) of sixteen young from Gainesville, measuring only 31 to 53 mm. in total length and averaging 40.4 mm., we find one with thirty-six costal grooves, eleven with thirty-seven, three with thirty-eight, and one with thirty-nine. In contrast to this series the Imboden specimens, although measuring approximately the same length (35 to 57 mm. total length; 36.8 mm. in average), have a consistently lower number of costal grooves. There are two with thirty-four costal grooves and twelve with thirty-five. Moreover, we have counted the costal grooves in a large series of adults from both localities and have failed to find evidence of an increase in the number of costal grooves with advancing age.

Convincing evidence that Cope had before him two species, when describing *lacertina*, is to be found in the fact that several of the small specimens he mentions are sexually mature females with large pigmented eggs in the ovaries. For example, U.S.N.M. No. 4535, mentioned above, includes no less than five females with pigmented eggs in the ovaries measuring 2 to 2.5 mm. in diameter. These five specimens agree in having only thirty-two costal grooves. They differ only slightly in size. Their length from snout to anterior corner of cloaca, followed by their total length, is as follows: 142–237; 145–225; 137–210; 139–220; 122–237 mm. These specimens come from Riceboro, Georgia. In the collections of the American Museum there is a female from Valdosta, Georgia, having eggs from 2.5 to 3 mm. in diameter in the oviducts. This specimen has thirty-three costal grooves and is only 128 mm. from snout to cloaca and 195 mm. in total length. It is clear that in Georgia some sirens breed at a small size and these have a low number of costal grooves. In striking contrast a series of breeding females from Gaines-

ville, Florida, ranges from 450 to 500 mm. from snout to cloaca, and is proportionately much greater in girth than are the Georgia specimens. Such a marked difference in size in breeding females seems definite evidence that the Riceboro and Gainesville specimens represent distinct species.

Cope (1889) had before him both our large and small forms of *Siren* collected at the same locality. In the large series of *Siren* in the United States National Museum collected at Oakley, South Carolina, there are breeding females of both forms present, as the following table shows:

Siren lacertina from Oakley, S. C.

U.S.N.M.	Size of Ovarian Eggs	Snout to Ant. Corner of Cloaca	Total Length	No. of Costal Grooves
14111	3 mm.	416	596	38
10875	3 mm.	400	560	38

Siren intermedia from Oakley, S. C.

9193	2 mm. (most of ovary in post-ovulation condition)	140	215	32
10872	2.5 mm.	140	198	33
14111	2.5 mm.	132	211	32
14111	2.5 mm.	134	217	32
14111	2.5 mm.	126	204	32

Similarly, in the series of specimens in the National Museum from Upson, Maverick Co., Texas, the *Siren* with large ovarian eggs fall into two size-groups. Moreover, the smaller individuals have fewer costal grooves than those in the large-size group. However, females of the small-size group are larger than the small Georgia *Siren* recorded above as *S. intermedia*. Their costal grooves number rises to thirty-five, which appears to be the average from Imboden specimens. Breeding females from Imboden, however, are not as large as the small form from Texas.

Siren lacertina from Upson, Maverick Co., Texas

U.S.N.M.	Diameter of Ovarian Eggs	Snout to Cloaca	Total Length	No. of Costal Grooves
10861	3.5 mm.	365	550	37
10857	3 0 mm.	430	640	39

Siren intermedia from the same locality

10853	2 mm.	272	382	35

Recently hatched *intermedia* from Imboden are stouter and have a more rounded head than young *lacertina* from Gainesville. A similar difference in the shape of the head is frequently observable in adult specimens. However, most specimens that have been preserved in alcohol for a long time fail to show a form difference. Hence the number of costal grooves and the size at sexual maturity are the only diagnostic characters available for use with this material. It is difficult to judge the degree of sexual maturity outside of the breeding season in many specimens, especially in the males. This restricts us to the use of a single character, namely the number of costal grooves, in identifying non-breeding specimens under 350 mm. from snout to cloaca. A study of the large series of *Siren* in the U. S. National Museum, the Museum of Comparative Zoölogy, and The American Museum of Natural History, has revealed that there is a constant average difference between the forms but that some non-breeding specimens having thirty-six coastal grooves may, from the data available, be equally well assigned to either species. We have found no sexually mature female over 365 mm. from snout to cloaca with less than thirty-six costal grooves, and no sexually mature female under 272 mm. snout to vent with more than thirty-six costal grooves. Specimens with thirty-six costal grooves and the gonads not enlarged must for the present be considered indeterminable.

There are two males in the U. S. National Museum from Victoria, Texas, each with thirty-four costal grooves. The first of these (U.S.N.M. No. 7849) is 300 mm. from snout to cloaca and 462 mm. total length. The second (U.S.N.M. No. 78480) would be nearly as long if the tip of the tail had not been cut off. These males are much larger than males of *intermedia* from Georgia or Arkansas. Still, they are not as large as typical *lacertina* from Texas and they have fewer costal grooves. These may be intermediates between *lacertina* and *intermedia* or they may be

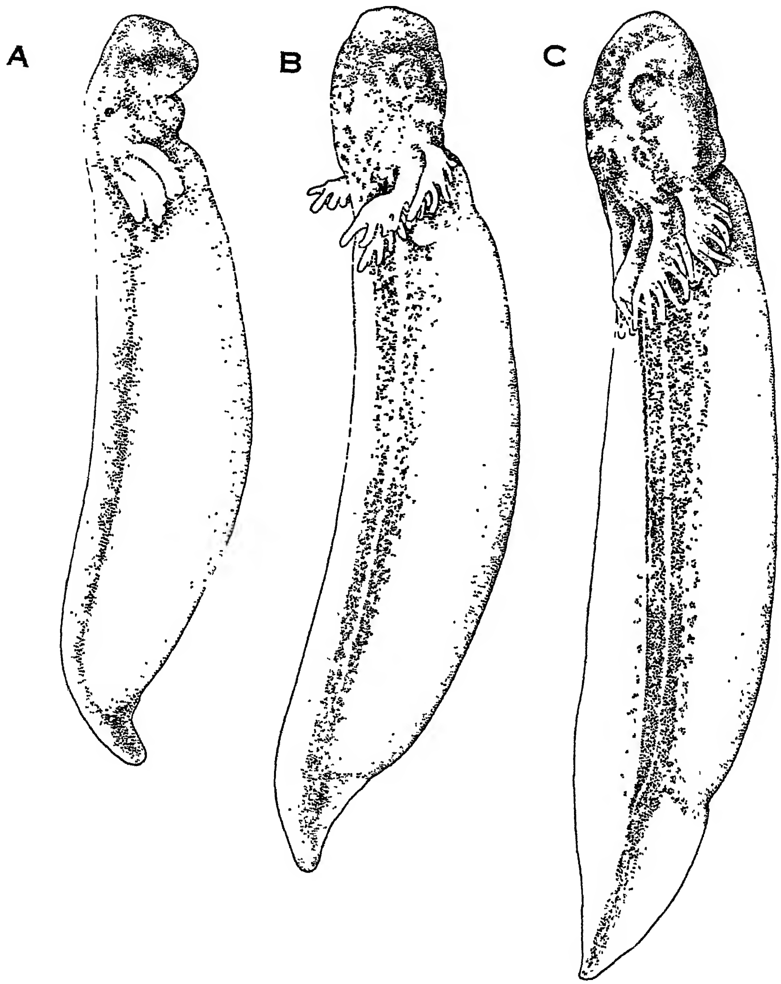


Fig. 2.—The development of *Siren intermedia* LeConte.

A.—Four days before hatching. There is a slight tinge of pigment but no pattern has become established. The dorsal fin has not yet appeared.
B.—At hatching. Forelimb buds are present and the nasal pits form shallow pockets. A thick fold marks the beginning of a dorsal fin. Balancers never appear even as rudiments.
C.—Four days after hatching. The forelimb buds are well developed but no digits have yet differentiated. The color pattern is nearly established.

very old males of the latter species. From the data at hand we cannot settle this problem.

In spite of this uncertainty in regard to some of the Texas material, *intermedia* is usually to be distinguished from *lacertina* by the lower number of costal grooves. In some poorly preserved specimens the costal grooves cannot be counted. Leaving these specimens aside, the remaining ones in the U. S. National Museum, the Museum of Comparative Zoölogy, and The American Museum of Natural History fall into the following modes:

Siren intermedia: one specimen with 31 grooves, eighteen with 32, seven with 33, twelve with 34, thirty-three with 35, and eight with 36.

Siren lacertina: four specimens with 36, twenty-eight with 37, twenty with 38, and six with 39.

Indeterminate: eight specimens with 36. These specimens are not in a breeding state and may be immature *lacertina* or non-breeding *intermedia*

Our smallest breeding females and all those with only thirty-one and thirty-two costal grooves come from Georgia and South Carolina. Future work may show that this is not identical with the *Siren* of the central states, which have from thirty-four to thirty-six costal grooves and rarely thirty-three. Our largest specimen with thirty-two costal grooves is a male (M.C.Z., No. 140) from Georgetown, S. C. It measures 212 mm. from snout to cloaca and 347 mm. in total length. In size it agrees well with male *intermedia* of the central states. We have examined a series of recently hatched young from Biloxi, Mississippi, and found them identical with the Imboden material, and different from the Florida *lacertina*. Until the life history of the small *Siren* of Georgia and South Carolina has been worked out it seems most conservative to assume there are only two species of *Siren*.

The range of *intermedia* seems to be more extensive than that of *lacertina*, except in the East. We have seen a specimen of *lacertina* taken on the Potomac Flats, District of Columbia, while we have seen no specimen of *intermedia* taken farther north than Guiney Station, Virginia. *Lacertina* occurs in Texas and Florida, but all the specimens from the central states, which we have seen, are *intermedia*. We have seen a sexually immature specimen with thirty-six costal grooves from New Orleans, La., but all the Biloxi, Mississippi, specimens available are *intermedia*. It is possible that *lacertina* does not occur today in the Mississippi Valley, but until more collecting has been done in Alabama and Mississippi we prefer to assume that the range of *lacertina* is not split in two by that of *intermedia*.

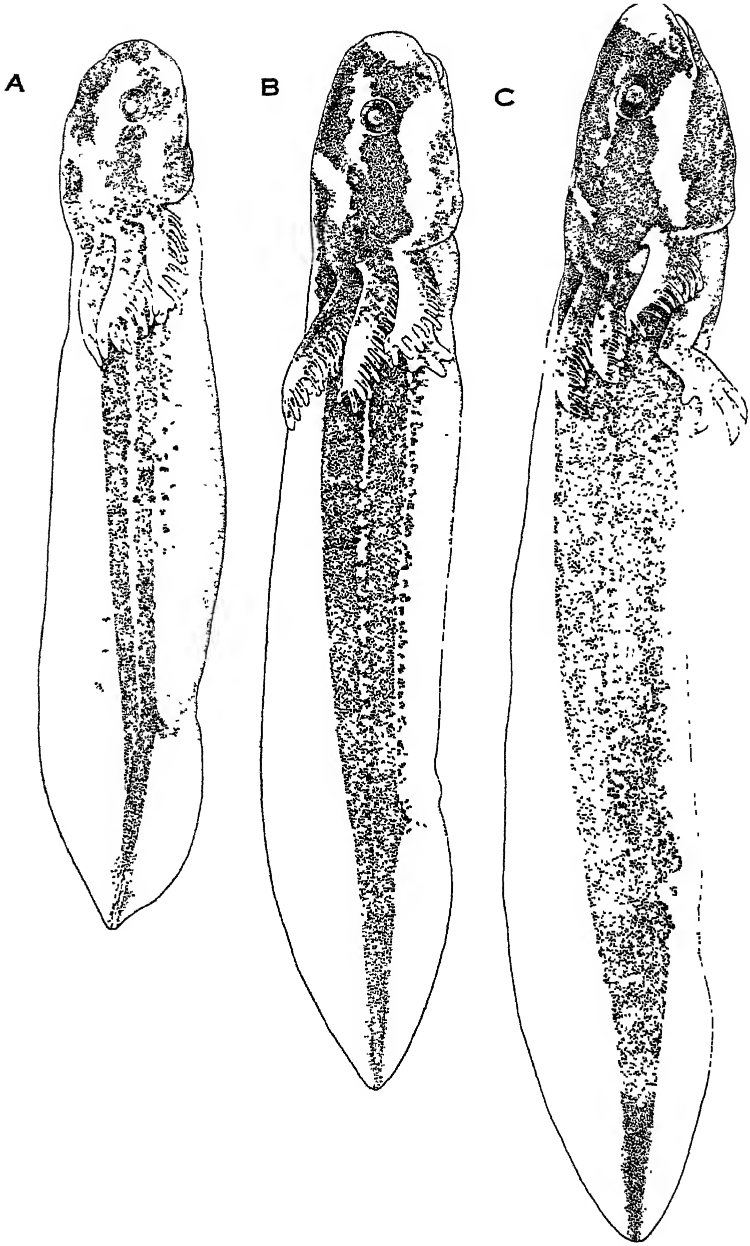


Fig. 3.—Young *Siren intermedia* LeConte.

A.—Ten days after hatching only the first digit has become marked off from the forelimb rudiment.
B.—Twenty-five days after hatching. Three toes are present on the forelimbs and the fourth is represented by a slight protuberance. The dorsal fin has reached its maximum growth.
C.—Fifty-one days after hatching. Three of the toes bear horny claws. The dorsal fin is becoming reduced at its extreme anterior end. The yellow stripes on the head have narrowed.

The Egg-laying of *Siren intermedia*

Our observations on the egg-laying of the Dwarf Siren were made near Imboden, Lawrence County, in the north east corner of Arkansas. The land from three to eight miles south of Imboden is flat and is locally called the "flat woods." It is on the edge of the Arkansas plateau bordering the gulf coastal plain which extends up the Mississippi Valley. The elevation of this region is approximately 800 feet above sea-level. All records of *Siren* from the State are from localities lying within or bordering the northward extension of the coastal plain.

Siren intermedia in the Imboden region appears to be confined to the J. E. Rosa Pond, the Cross Roads Pond, the D. V. Pickett Pond, and the E. Milgrim Pond. These ponds are within a range of one mile and in the spring of the year when heavy rains fall they are connected by slow-flowing streams which join ditches and creeks affording a route by which *Siren* and small fish may gain access to the ponds. There are several other ponds within a radius of two or three miles of the above ponds, but none of these contains *Siren*. Some of these ponds have been well scraped over by collectors, and others have been diligently searched without finding a trace of *Siren*.

The search for the eggs of *Siren* in those ponds frequented by the adults has been carried on since 1926 and extended from early spring to July. During the last week in February, 1931, several sirens measuring 255 to 396 mm. in total length were captured. The largest specimen, which appeared unusually plump, was killed and opened. Its ovaries were distended with eggs ranging from 1.5 to nearly 3 mm. in diameter. There were 139 eggs in the right ovary and 160 in the left, a total of 299. Several of the other sirens captured in February were held in tanks. During the last week in March and the first week in April several eggs were laid on successive nights. None of these eggs was fertile. This may have been due to the fact that no males were present, but in view of some recent work with the egg-laying in *S. lacertina* (Noble and Richards, 1932) courtship may be difficult in *Siren* under laboratory conditions.

On April 8, 1931, a boy collecting in the D. V. Pickett Pond raised a shovel filled with mud to the surface of the water and saw a full-sized *S. intermedia* glide away from the mud. The contents of the shovel was thrown on the ground near the edge of the pond and, as it broke up, a mass of eggs was revealed. The eggs were in a pocket, in the mud, about three inches deep. The mud had been taken from near a snag formed by

a dead bush with the branches broken and piled together. There were about 555 eggs in the lot, a number considerably in excess of the eggs counted in the ovary of the female taken in February. These eggs were very far advanced. They were in approximately the stage shown in figure 2 A.

On April 10, another lot of *Siren* eggs were found at the Cross Roads Pond. The land where the pond is situated lies at such a slope that, by making a ditch on the east side, some of the water could be drained off. After most of the pond had been drained by this method a search for *Siren* eggs began. Many small *Siren* and a few adults were found. Several button-bushes were growing in the pond, and in the mud among the roots of one of these bushes, which had been pulled up and carried out to a dry place, were found 260 eggs in approximately the same stage as those taken on April 8. Some eggs may have been lost in removing the lot and, hence, the actual number of eggs present in this case is uncertain. This observation, however, gave support to our previous conclusion that *S. intermedia* lays its eggs in shallow hollows in the mud at the bottom of ponds. Which parent, if either, makes this "nest" is at present uncertain. The first lot of eggs appeared to have been guarded by an adult, but unfortunately this individual was not caught and hence its sex was not determined.

The Egg.—The ovarian eggs of the specimen killed February 18, 1931, and preserved in formalin, measure 3 mm. in diameter. One hemisphere is well pigmented, the chocolate tone fading off into the unpigmented hemisphere. The periphery of the pigmented area is darker than the center in only a few eggs. Hence, at this stage the eggs of *S. intermedia* do not agree with the recently laid eggs of *S. lacertina* as described by Noble and Richards (1932). Our recently laid eggs of *intermedia* died before being preserved, but some of the eggs are darker at the periphery of the pigmented area than in the center. We assume this to be typical of the species.

The eggs of *intermedia* laid in the laboratory agree with those of *lacertina* and of *Pseudobranchus* laid under laboratory conditions in that three capsules are present. Further, the outer capsule is slightly opaque as in the case of these other sirenids. The eggs agree mostly with those of *Pseudobranchus* (Noble and Richards, 1932, Fig. 5 A) in that the inner capsule is very thin. The eggs of *S. intermedia* differ from those of the other sirenids in that the middle and especially the outer capsules are very much thinner. An average egg of *S. intermedia* measures 3 mm. in diameter without capsules. The inner capsule is a thin membrane of

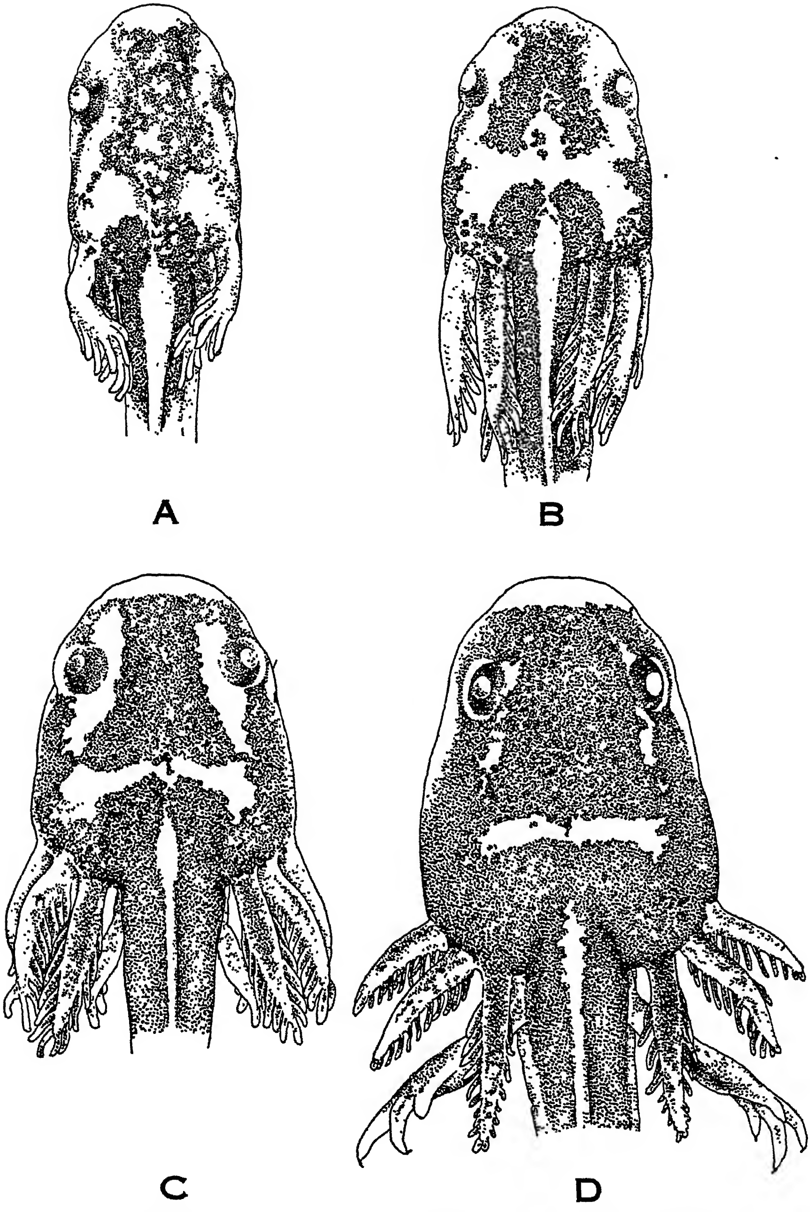


Fig. 4.—Development of the color pattern on the head of *Siren intermedia* LeConte.

A —Four days after hatching.
B.—Ten days after hatching.
C.—Twenty-five days after hatching.
D.—Fifty-one days after hatching.

4 mm. in greatest diameter. The space between this capsule and the egg is filled with a fluid, as in other sirenids. The middle capsule is 4.2 mm. in diameter, the outer only 4.4 mm. In striking contrast, the eggs of *S. lacertina* are much larger and have thicker capsules (compare Noble and Richards, 1932, Fig. 5 B). An average egg of *S. lacertina* laid in the laboratory and fixed in formalin several days after laying measures 4 mm. in diameter. Its inner capsule is 5.3 mm. in diameter, its middle capsule 6.2, and its outer capsule 9 mm.

It would be interesting to compare freshly laid and fertile eggs of the two species of *Siren*. The egg-capsules of *S. lacertina* swelled after laying. We have, however, a large series of eggs of *S. intermedia* taken in the field, as described above, and in none of these is the outer capsule swollen beyond the conditions seen in the laboratory eggs. Our conclusions in regard to the egg-capsules of *S. lacertina* rest entirely on observations made on the eggs of a single female. However, we have noticed that the eggs from the ovaries and oviducts of *intermedia* are consistently smaller than fully developed ovarian eggs of *lacertina*. Thus, while further observations on the egg-capsules of these species are much to be desired, there is no doubt that *lacertina* lays larger eggs than *intermedia*. Since we have compared eggs of the two species laid and preserved under comparable conditions, we have concluded that there is also a marked difference in the egg-capsules of the two forms.

The eggs of *intermedia* adhere together in a clump. Some of the eggs from one of the clumps is shown in figure 1. Under laboratory conditions, *lacertina* lays its eggs scattered singly or in small groups. It is possible that in nature the eggs would be laid in a single group. In the laboratory, *intermedia* laid its eggs exactly like *lacertina*, a few each night for an extended period. The outer capsules of these eggs were very sticky and adhered to one another, to the sides of the tanks, and to the tail-fins of the adults.

The eggs of *intermedia*, immediately before hatching, measure from 5.5 to 6.5 mm. in diameter including all the capsules. They adhere closely to one another and there are no cords or pedicels to the individual eggs. The outer capsule is extremely thin and membranous. As shown in figure 1, small sticks and other debris adhere to it.

Development.—Some of the eggs were preserved the day collected. The earliest stage represented in either lot is shown in figure 2 A. The embryo is already well developed. The three gill-rudiments have begun to develop secondary processes. The forelimbs are indicated by buds. The remarkable feature of this embryo is its slim form. It is 10.5 mm. long by only 2.1 mm. high.

As shown in figure 2 A, the stomadæum at this early stage is well marked. The mandibular arches are well formed and meet in the mid-line, but the point of symphysis is broadly notched anteriorly. The nasal pits are already present as shallow pockets. The optic vesicles are distinct but not well marked off from a swelling on each side which appears to be the placode of the trigeminal nerve. The vent has arisen at this stage as a shallow pit at the base of a very short tail.

At the time of hatching, four days later, several important changes have occurred (Fig. 2 B). Perhaps the most distinctive is a dorsal ridge which is destined to become a conspicuous dorsal fin. This structure has not been reported in the young *S. lacertina,* probably because no sufficiently early stages of that species have been collected. Dorsal fins are characteristic in general of salamander larvæ living in ponds (Noble 1927), but another feature common to pond larvæ, the balancer, is not present at this stage and never appears.

At the time of hatching, a color pattern is already present. At the stage described above, only a few pale melanophores are visible on the dorsum, but at hatching a dark stripe extends along either side of the back and is divided by the pigmentless crest which is to become the dorsal fin. On either side this stripe is divided by a narrow pigmentless line. As shown in figure 4 A, some pigment has appeared on the top of the head and this is destined to form the pattern which we find distinguishes *intermedia* from *lacertina.*

At hatching, both the buccal and cloacal depressions are shallower than in the preceding stage. The nasal pits and eyes are better formed and the gills now have many branches. During the next fifty-five days, the young *Siren* gradually assumes the head-form it is to retain for the remainder of its life. As shown in figure 2 C, the nasal pits arise directly under the anterior margin of the eye. In the change of head-form they are carried out with the developing snout. On the tenth day after hatching the mouth is represented by a crescentic groove anterior to which is a shallow pocket which may represent a hypophysial depression. The mouth becomes perforate between the twelfth and fourteenth days. The cloaca may open by the ninth day. Labial folds appear about the time the mouth opens and are well established by the sixteenth day. The growth of the forelimb is shown in the figures. By fifty-five days after hatching, the forelimbs are fully formed and all but the fourth digit are covered with horny claws. The most distinctive feature of these young salamanders is their absurdly short tails. The long body of *Siren,* one of its most characteristic features, is established very early and, as

if to compensate for this attenuation of body, the tail remains short during this period, while in other salamanders it is rapidly growing in length.

In figures 2 C, 3 and 4, we have represented four stages in the growth of the color pattern. In addition to the narrow white streak down either side of the body there appears another thin white line along either side of the belly. In some specimens there is still a third streak of white on either side at the base of the dorsal fin, barely within the pigmented area. In view of the relation of pigmentless areas to the lateral-line organs in various other salamanders, it would appear probable that these three streaks represent the course of the lateral-line organs. Some lateral-line organs may be seen within the pigmentless areas, but the full distribution of these organs cannot be traced in our formalin preserved material without sectioning.

The pigmentless areas on the head early become invaded by lipophores which give these areas a bright yellow tone. In some specimens the yellow on the gills may be orange or reddish. As shown in figure 4, these yellow areas become gradually narrowed, and nine months after hatching the transverse bar on the occiput and the two horizontal streaks over the eyes have practically disappeared, leaving only the broad band of yellow on the snout to distinguish these larvæ at a glance from those of *lacertina*.

Another gradual change which begins approximately two months after hatching is the reduction of the dorsal fin. At seven months the reduction is far advanced, and at nine months the salamanders have the same reduction seen in the adults. These observations were made on young reared in the laboratory, and it is possible the reduction of dorsal fin proceeds more quickly in nature. We have seen larvæ only 46 mm. in total length, collected near Imboden on June 20, that showed a complete reduction of the dorsal fin.

We have not been very successful in correlating size groups secured in the field with age groups worked out in the laboratory. On May 18, 1929, a young *Siren* only 24.5 mm. in total length was captured at Milgrim Pond. Several others, 50 to 75 mm. in length, were taken June 11, 1927, from the same pond. At the same time many *Siren*, 150 to 250 mm. in length and averaging 200 mm., were secured. It might be assumed from these data that the two last size groups represent young of two succeeding years, and that the 24.5 mm. salamander belonged to a group which would reach 50 mm. in length by the middle of June. But the young we have raised in the laboratory did not grow this fast.

We have raised two lots of *intermedia:* one in New York and the other in Imboden. The first was kept in spring water and fed enchytræids; the second lot was reared in half-gallon fruit jars supplied with diatoms. At the end of fifty-five days average specimens from both lots were 22 mm. in total length. This is the more surprising in that hatching occurred in the laboratory from April 16 to April 26. It would indicate that the young during this period depended to a large extent on their yolk.

Six of the young *Siren* have lived nine months in New York, apparently feeding on the enchytræids. On November 4 they measured 38, 41.5, 42, 53, 58, and 61 mm. in total length respectively. On January 26 they measured 45, 48.5, 51, 60.5, 61, and 69. This would appear to indicate that the 50 to 75 mm. *Siren* captured in June were over a year old, and not young of that year. It will be noticed, however, that some *Siren* grew nearly twice as fast as others and it is not unlikely that under natural conditions they grow faster than in the laboratory. It is also possible that *Siren* has a more extended breeding season than we have been able to determine. Until more data are available it is impossible to determine the age of *intermedia* at sexual maturity.

Habits of the Adult

S. intermedia appears to be entirely aquatic for, in spite of extensive collecting during many years about Imboden, none has ever been found on land. In the case of *lacertina* there are several records of this species being found on land. In one case observed by Noble the salamander was under a stone in a hollow which previously may have been filled by rain-water.

Although *Siren* was one of the earliest salamanders described from America and was well known to the early American naturalists, there is still considerable uncertainty in regard to its food. LeConte (1824, p. 53) remarks in regard to the stomach of *lacertina:* " I have never found that organ to contain anything but mud." Dunn (1924) called attention to the large quantity of vegetable matter in the stomachs of this species. We have noticed that adult *intermedia* for several days after their capture expel great quantities of partly disintegrated *Spirogyra* from their intestines. This is accompanied by pieces of the exoskeleton of crayfish and the shells of bivalves. Dr. W. Van Name has kindly identified one of these molluscs and found it to be *Sphærium occidentale.* In the laboratory we have found that *lacertina* will devour *Spirogyra* with their earthworms. The quantity of algæ expelled by *intermedia*

far exceeds the residue of animal food. It is therefore certain that *intermedia* normally devours large quantities of algæ. At the present time we have not been able to establish that either species of *Siren* will eat algæ alone, unaccompanied by animal food.

Much of the collecting for *intermedia* was done at night, with lights. Between 10 P.M. and morning, adults are often seen, but at the first streak of dawn they disappear. If they are disturbed from the mass of thick water-weed in which they hide they will swim swiftly to another retreat of darkness. Relatively few are seen before 10 P.M. in the evening. According to our observations in Florida, *lacertina* has similar nocturnal habits. However, we have seen many early in the evening. A *lacertina*, disturbed during the day, will make off through a dense growth of water-weed with a very surprising speed.

ACKNOWLEDGMENTS

We are indebted to Dr. Thomas Barbour for the opportunity of studying the collection of *Siren* in the Museum of Comparative Zoölogy. We wish to acknowledge our indebtedness to Dr. L. Stejneger for the loan of a series of *Siren* preserved in the National Museum collection.

SUMMARY

1.—There are two species of *Siren* widely distributed throughout United States. These are distinguished by size at ovulation, the average number of costal grooves, the size of the eggs, thickness of the egg-capsules, the coloration of the young for nine months after hatching, and the body proportions for a more extended period.

2.—LeConte did not distinguish between these species when describing *Siren intermedia*, but we reinstate this name usually placed in the synonymy of *lacertina* and restrict it to the smaller species described here.

3.—The recently hatched young of *S. intermedia* is remarkable for its long body, short tail, and broad dorsal fin extending the full length of the back.

4.—Changes taking place in the head and forelimbs during the first fifty-five days after hatching are described. No balancer ever appears.

5.—Reduction of the dorsal fin begins about two months after hatching but is not complete in some specimens until nine months.

6.—Both species of *Siren* are nocturnal. The adult *intermedia* devours quantities of *Spirogyra* and possibly other algæ with its animal food which consists of crayfish and molluscs.

LITERATURE CITED

COPE, E. D. 1889. 'The Batrachia of North America.' Bull. U. S. N. M., No. 34.

DUNN, E. R. 1924. '*Siren*, a Herbivorous Salamander.' Science (N.S.), LIX, p. 145.

ELLIS, JOHN. 1766. 'An Account of Amphibious Bipes.' Philos. Trans. Roy. Soc., London, LVI, pp. 189–192.

LeConte, John. 1824. 'Description of a New Species of *Siren*, with some Observations of Animals of a Similar Nature.' Ann. Lyceum Nat. Hist., N. Y., I, pp. 52–58.

1826. 'Description of a New Species of *Siren*.' Ann. Lyceum Nat. Hist., N. Y. pp. 133–134.

Linné, C. 1767. 'Systema Naturæ.' 13th Ed.

Noble, G. K. 1924. 'The "Retrograde Metamorphosis" of Sirenidæ; Experiments on the Functional Activity of the Thyroid of the Perennibranchs.' Anat. Rec. XXIX, p. 100.

1927. 'The Value of Life-history Data in the Study of the Evolution of the Amphibia.' Ann. N. Y. Acad. Sci., XXX, pp. 31–128.

Noble, G. K., and Richards, L. B. 1932. 'Experiments on the Egg-laying of Salamanders.' Amer. Mus. Novitates, No. 513, pp. 1–25.

AMERICAN MUSEUM NOVITATES

Number 533 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | June 2, 1932

59 79 D

OBSERVATIONS AND EXPERIMENTS ON THE LIFE HISTORY OF THE SALAMANDER, *DESMOGNATHUS FUSCUS FUSCUS* (RAFINESQUE)

BY G. K. NOBLE AND GERTRUDE EVANS

The common Dusky Salamander, *Desmognathus fuscus fuscus*, is one of the best known of American salamanders. Its life history, thanks to the studies of several investigators, especially Wilder (1913, 1917), has been worked out in considerable detail. Dunn (1926) has reviewed the literature and summarized the features of especial interest to naturalists. Since Dunn's monograph appeared, several contributions have been made to the life history of this salamander. A different interpretation of the color pattern formation has been made (Noble, 1927), the spermatophore has been described in detail, and the distinctive features of the spermatozoon analyzed (Noble and Weber, 1929). Most phases of the courtship have been witnessed (Noble and Brady, 1930) and the courtship of the closely related *D. quadra-maculatus* observed in full detail (Noble, 1931). Since spermatophores of *D. f. fuscus* have been found in fall, spring, and summer, the courting season is apparently very extended. The hatching of the eggs is not due to "sufficient friction" of the enclosed embryo as Wilder (1913) assumed but to the digestive action of a series of unicellular glands scattered over the embryo's snout (Noble and Brady, in press). The present paper represents a continuation of these studies. It includes an analysis of the brooding habit, the larval life, and the habitat selection of the adult.

It is well known that the eggs of *D. f. fuscus* are laid on land and are guarded by the mother. Wilder (1917) has made detailed observations on the brooding habit and has found that a brooding female will guard the eggs of another individual. When a female that had been brooding eggs until the time of hatching was introduced into the "nest" of another female she assumed an unusual pose: "instead of lying among them with her body coiled about them, she stood over them with her body elevated so that the eggs were beneath the belly and only slightly in contact with them . . . . she was invariably found in the same peculiar attitude with relation to the eggs, and always with the head oriented in the same direction."

This unusual pose was the same as that which the rightful owner of the eggs had assumed when brooding them. Wilder (p. 16) comments on this situation in part:

"Of course there is no means for determining whether the actual finding of the eggs by the foster mother was a reaction to the proximity of the eggs themselves, or was a purely accidental occurrence, since *Desmognathus* frequently seeks out positions under stones and other objects lying upon the surface. . . . The peculiar position and orientation of the bodies of the two females while successively brooding this particular batch of eggs is most satisfactorily explained, however, as a response to some unusual conditions in the surroundings of the nest, such as the possible entrance of a little light into the nest from one direction."

Since Wilder's conclusions were based upon a single experiment it seemed to us desirable to secure additional data on the brooding poses of *D. f. fuscus*. It also seemed desirable to perform additional experiments in exchanging the eggs before accepting the conclusion that females will adopt the eggs of other females. By means of the pituitary technique it is possible to secure the eggs of a large number of females at one time. We have induced sixteen females to lay their eggs in the laboratory by implanting the anterior pituitaries of a series of *Rana pipiens* under the skin of their throats. The salamanders were maintained in separate crystallizing dishes provided with damp sand, moss, and frequently some small sticks or stones added to serve as additional cover. The eggs when brooded usually developed normally in these dishes.

Our observations on the fourteen females that laid eggs and began to brood them showed conclusively that no one pose is assumed during brooding to the exclusion of all others. When returning to the egg-mass after being removed from it the female usually lowers her head and thrusts her head and shoulders under or between the eggs (Noble, 1931a, Fig. 136). However, she may partly coil about the eggs. Most of the eggs in our series were laid under the moss in such a position that they could not be examined without the risk of disturbing the female. One female in the series laid her eggs against the side of the dish and we were able to make observations on her behavior during brooding without lifting the moss. The female, No. 6 in our series, laid on April 23 after receiving three implants of frog anterior pituitary. A summary of our record follows:

The eggs were laid in a single cluster hanging from some moss in contact with the glass side of the dish. From April 23 to 27 the female was frequently observed. Sometimes she remained beneath the eggs

with her head bent at a sharp angle to her body and thrust up among the eggs. In this position the throat of the female was in contact with the glass and the top of her head with the eggs. At other times she was flat on the bottom of the dish with her head facing outward and directly below the eggs. On May 1, the female was found to have assumed a third position. She was lying on her back with her head bent at an angle to her body and the top of her head against the side of the dish. On May 2, the female had pushed up into the cluster of eggs while keeping her back to the side of the dish. In this position the weight of her body was supported in part by the bent tail. On May 4, she had moved to a position below the eggs and lay between sand and moss. On May 5, she was in the same position.

In 1913, Wilder wrote (p. 262) "I have no evidence that the habit of eating the eggs, such as Smith ('07) found in the case of *Cryptobranchus*, is ever indulged in by *Desmognathus*, although, as will be shown below, this species is by no means to be exempted from the charge of cannibalism."

Among the sixteen females that were induced to breed in our laboratory we have proved that two devoured most of their own eggs. In neither case had the brooding habit been fully established before the destruction of the eggs began. In the first case a female laid her eggs April 20 in the usual two clusters but these were deposited in two different places in the dish. By April 23, no brooding habit had been established. By May 4, the eggs appeared to be reduced in number and a supply of enchytræids was added as a source of food. Nevertheless, by the following day, only three eggs were left. These were developing normally. The enchytræids had widely spread over the dish. On May 6, the female was killed and thirteen eggs were found in her stomach. No mature eggs were in the ovary.

The second case of egg eating occurred in specimen No. 8, which was induced to lay by implanting two frog anterior pituitaries on May 6 and two *Gyrinophilus* pituitaries on May 8. The eggs were laid May 11, but the female did not brood the eggs on the following day. Her body held against the side of the glass gave evidence of her having eaten a few eggs. The eggs were therefore removed to one of the upper layers of moss. This dish was examined on May 14, 23, 25 and 26, but the female was never seen with the eggs. By June 1, only three eggs were left. The others could be readily seen distending the stomach of the female. On June 4, the three eggs still remained. These were preserved as well as the female. An autopsy revealed that she had laid all the mature

eggs in her ovary. This was done apparently before eating any of those laid.

In order to determine whether the female was interested in her eggs more than in the protected retreat where they were laid we have performed a series of experiments. The experiment with salamander No. 10 may be considered typical of this series. The salamander laid her eggs June 15, after four implants of frog pituitary. She coiled about them and began at once to brood. On June 16, the female was driven from her burrow and the eggs removed to a new hollow on the opposite side of the dish. On June 17, the female was not seen to brood the eggs and on the 18th the eggs were moved back to the original hollow to which the female had returned. No brooding was observed until June 22, when the female was found in contact with her eggs throughout the day. At 5 P.M. the eggs were removed to the opposite side of the dish and seven artificial eggs constructed out of paraffin coated with gelatin and agreeing closely with the original eggs in size were placed with the female. She remained in contact with these artificial eggs throughout the 23d until she was driven from her burrow late in the day. On the 24th the female had returned and was in contact with the artificial eggs. She was driven from the burrow and was not seen in it the next day. During this period she did not brood her eggs which had been removed to a little burrow in the moss on the other side of the dish. On July 1, the artificial eggs were removed and the female's eggs were returned to their original location in the burrow where they were laid. The next day the female was back in the burrow and brooding the eggs. On July 3, the eggs were removed again a short distance from the original burrow and some artificial eggs constructed of agar jelly were placed in the original site of egg-laying. On July 6, the female was back in the burrow and lying among the lumps of agar which had lost much of their original resemblance to eggs. On July 7, 8 and 9 she was not in the burrow or near her eggs. On the 10th she had found her eggs and was brooding them. It was apparent from these experiments that a female *D. f. fuscus* will brood artificial eggs if these are placed in the original site of egg-laying. She will apparently return to the original burrow in preference to hunting for her eggs placed a few centimeters away.

If a brooding female is shifted into another crystallizing dish containing an unprotected cluster of eggs she will usually lose little time in finding and brooding these foreign eggs. For example, salamander No. 10, discussed above, was shifted to dish No. 14 on July 13 and the next day was found with head thrust among the eggs in the usual brooding

posture. On the same day, she was transferred to dish 15 and was found close to these eggs the following day. On July 16, she was also apparently brooding the eggs but left them when the cover of moss was lifted. She was shifted the same day to dish 17 and was found brooding these eggs on July 23. On that day she was placed back in her own dish where she continued to brood her eggs until July 31, when some of them hatched.

We have introduced the eggs of other species of Amphibia into the breeding dishes of *Desmognathus* and have also tested the reactions of the brooding female to damp objects. Our experiments with salamander No. 1 may be considered representative of this type of experiment. The salamander laid her eggs March 23 after receiving three implants of frog anterior pituitary. She coiled about them at once and did not move when the stone covering the eggs was lifted. On March 31, at 3:30 P.M. the eggs were removed to the opposite side of the dish and a mass of moist filter paper was placed under the stone in the position previously occupied by the eggs. By 5 P.M. the same day, the female had found the eggs and was brooding them. Here was a case where the female was much more attracted by her eggs than by her nesting site.

The experiment was carried further by transferring the female to a foreign breeding dish. The dish selected, No. 2 in our series, contained a brooding female which had been particularly attentive to her eggs. She had laid fifteen eggs on March 21 and thirteen more on March 23, thus breaking the rule of laying her eggs in one night. She was driven from her eggs at 3 P.M., March 31, but had returned to them by the following morning. The eggs had been laid in two clumps, one near the edge of the dish and the other in the center. There was a well-marked burrow between the two sets of eggs. The female was usually to be found with her tail in contact with the more scattered group in the center of the dish under a stone, and her head directed toward the other group of eggs. On one occasion she was found in exactly the opposite orientation. When salamander No. 1 was introduced into this dish on April 2, she did not brood either set of eggs that day. On April 4, she was brooding one lot and not trying to brood both as in the case of the rightful owner.

The salamander was next returned to her original dish (No. 1) and the eggs were placed in another part of the dish. By April 6, she had found the eggs and was lying with head thrust among the eggs even though these were at a distance from the original egg-laying site. On April 8 at 10 A.M. the female was still brooding these eggs. She was driven away and the eggs were returned to the original site of laying on the opposite side of the dish. A clump of wet paper towel was placed in the

hollow where the female had been brooding for at least two days. By 9:30 A.M. the next morning she had found the eggs and was brooding them. The eggs were then removed to the far side of the dish and replaced by fifteen well-developed eggs of *Ambystoma opacum*. These had been laid the previous fall and kept in good condition in an ice box. They were washed before being placed in the *Desmognathus* "nest." By 1:30 that afternoon the female had found her eggs in the new position and was brooding them. At that time the *Desmognathus* eggs were moved to a new spot, the *A. opacum* eggs were placed where the *Desmognathus* eggs had been, and some eggs of *Eurycea bislineata cirrigera* were placed in the position formerly occupied by *A. opacum* eggs. At 10:30 the following morning the female was found in contact with the *A. opacum* eggs. At 3:30 P.M. the female still had her head thrust among the *A. opacum* eggs. Some of the eggs had begun to hatch. The lot was then moved to the position of the *E. b. cirrigera* eggs and these were moved to a new position. Although there was now the possibility of brooding the eggs of three different kinds, no brooding was observed again. The *E. b. cirrigera* eggs molded and were removed, April 13. The unbrooded *Desmognathus* eggs remained in good condition and the embryos could be seen moving within the egg capsules on April 20.

It appeared to us quite possible that the female was not brooding the *A. opacum* eggs, but was merely lying with head thrust among them waiting for the young to hatch, whereupon she would devour them. Noble and Brady (in press) have shown that *D. f. fuscus* in nature will devour the eggs of *A. opacum*.

A series of experiments was devised using eggs constructed out of agar jelly, or masses of gelatine to attract the brooding *Desmognathus*. The females in general showed little interest in these artifacts. Their indifference stood in striking contrast to their response to their own eggs. Our experiments with salamander No. 14 may be considered typical of the series. The female laid her eggs June 18, after receiving five implants of frog anterior pituitary. The salamander brooded her eggs until June 24, when they were moved to another part of the dish without disturbing the female. The salamander was not seen brooding until June 29, when it was apparent that she had moved most of her eggs to a position near the center of the dish. On July 1, the cluster of eggs was moved back to the side of the dish where a few scattered eggs indicated the spot from whence they had been removed by the female. The next day the female was found in the center of the dish. Since the female showed no disposition to find her eggs, a mass of cold gelatine about the size of her egg-

mass was placed near the female in the center of the dish. The female did not come in contact with this gelatine that day or the next. In the afternoon of July 3, several small pieces of jellied agar were placed directly on the top of the female's head. On July 6, the female had found the eggs on the side of the dish and was brooding them. The eggs were moved back to the center of the dish and some new masses of jellied agar having the form of eggs were placed in the position occupied by the eggs. The next day the female had found her eggs in the middle of the dish and was brooding them. She remained in contact with them from July 7 to 13.

Our most extensive series of experiments was directed toward establishing the reaction of the female toward eggs of another female of the same species. The ease with which a female introduced into a foreign dish would find the eggs and the persistency with which she would brood them showed conclusively that the brooding female is attracted by eggs of its own species whether or not she laid them herself. In thirteen transfers of a brooding female to a foreign dish examined twenty-four hours later, the female was found to be brooding the foreign eggs eight times. For example, salamander No. 14 was transferred on July 13 to the dish of No. 10. The next day she was brooding the eggs with head thrust among the cluster. On that day she was transferred to dish No. 17. Apparently she brooded the eggs from July 15 to 17, when she was transferred again to dish No. 10. On July 23, she was found brooding the eggs and was transferred to dish No. 21. On July 30, apparently she was brooding the eggs of this female while her own eggs left in dish No. 14 were hatching. We use the word "apparently" above because in some cases, when the moss was lifted for purposes of observation, the female would withdraw slightly from the eggs. Although actual contact with the eggs was not observed at every examination, there can be no doubt that a brooding female exhibits considerable alacrity at finding the unprotected eggs of another female and will usually be found brooding them within twenty-four hours after being released in an unfamiliar dish containing the eggs.

In contrast to the above results, all of our cases of a female's apparent brooding of artificial eggs could be accounted for by assuming that the female tends to return to the location where she laid her eggs. If artificial eggs are placed in this position she may appear to brood them. We found no instance of a female's brooding artificial eggs in a nest made by the experimenter, although living *Desmognathus* eggs would attract a female to these locations. Our artificial eggs were constructed of gelatin,

of agar jelly, of moist paper towel, and of paraffin as described above, and they were placed in a wide variety of situations without calling forth the brooding response.

On August 28, 1930, one of us collected near Mt. Storm, West Virginia, a set of eggs of *Desmognathus fuscus fuscus* which had just hatched. On the same day near Table Rock, in extreme western Maryland, another set of eggs of the same species was secured just before hatching. The first lot of eggs was in a shallow mud basin under a rock, the second was on some rotting wood under a stump. Water flowed only 12 cm. from the first set while the second was near the edge of a damp stream bed. The latter nesting site was unusual in that the stream bed apparently had been made by rain-water and the permanent stream was several yards away. The recently hatched young of the first lot were placed in a tin container half full of damp moss, and were brought back to New York alive.

Early in September the contents of the container were transferred to a crystallizing dish 20 cm. in diameter and a supply of enchytræids added. On October 23, the young salamanders appeared to be in good condition. Six were removed to a similar crystallizing dish containing water approximately 2 cm. in depth. Six others were allowed to remain in the other crystallizing dish which contained damp moss but no free water on the bottom of the dish. White worms were again added to both dishes as a source of food. Both lots of young lived, and by March 5, 1931, it was found that some of those in the dish of damp moss had completely metamorphosed, while none in the water showed evidence of this change. We had found that *Desmognathus fuscus fuscus* was able to pass through its larval stages on land without having access to free water. Under these conditions metamorphosis occurred earlier than if the larvæ enjoyed a larval life in the water.

The larvæ reared in the damp moss invariably remained darker than those in the water, and this may have been due to the fact that the moss tended to screen them from the light.

Their gills were shorter and they did not grow as rapidly as the aquatic larvæ. The most striking difference between the larvæ was in the length and shape of the tail. Those reared in the moss had shorter tails in proportion to their body-lengths than those reared in water. Further, they lacked any evidence of the tail-fin which characterizes the aquatic larvæ. An average specimen of the lot reared on damp moss and preserved March 9 measures 15 mm. from tip of snout to cloaca, and 25 mm. in total length. An average specimen of the larva reared in

water on the same day measures 16 mm. from snout to cloaca and 30 mm. in total length.

By April 23, the aquatic larvæ had fully metamorphosed. One of the larvæ reared in moss was still incompletely metamorphosed. The temperature in the laboratory apparently had speeded up the development of the aquatic larvæ above the rate found in nature and doubtless also influenced the developmental rate of the terrestrial larvæ as well. The terrestrial habitat seemed to have hastened metamorphosis in some but not in all of the larvæ reared under moss. An average specimen of this lot reared under damp moss and preserved in formalin April 23 measures 15 mm. from snout to cloaca and 25.5 mm. in total length. In striking contrast, an average specimen of the lot reared in water measures 16 mm. from snout to cloaca and 31.5 mm. in total length. Therefore, the latter has a slightly larger body and a decidedly longer tail.

We have repeated the experiment with two additional sets of *D. f. fuscus* eggs. We secured both sets in March by implanting the anterior pituitary gland of frogs into female salamanders that happened to have spermatophores protruding from their cloacæ. Both salamanders had completed laying by March 23. Although both sets of eggs were kept on water-tables, one set began hatching May 9, and all in the set had hatched by May 16. The second set did not begin hatching until June 6, but all the eggs had hatched by June 15.

The recently hatched larvæ of the first set of eggs were divided into two lots. On May 18, one lot was placed in a crystallizing dish 20 cm. in diameter containing water 1 to 1.5 cm. in depth. The second was placed on wet sand in a crystallizing dish of the same size and covered with damp moss. A plentiful supply of enchytræids was added to both dishes and the latter were placed near each other on a table over which tap-water flowed continuously. At intervals, larvæ from both lots were preserved in formalin. On July 1, approximately forty-six days after hatching, some of the larvæ reared under the damp moss shed their skins in one or more large pieces. This shedding is considered definite evidence of metamorphosis in caducibranch salamanders. These larvæ had cut their usual larval period of about nine months to about one and one-half months. However, this shortening of the larval period was due not only to the enforced aerial respiration but also to the high temperatures that occurred during these months.

The second set of eggs was treated similarly to the first. They were divided into two lots on June 6. Seven of the eggs which had not hatched

by this day were placed in water. By June 8, they had hatched and the larvæ seemed very much at home in the water and made no attempt to crawl up the sides of the glass. Again, larvæ from both lots were preserved at frequent intervals. By July 10, when the experiment was discontinued, neither lot of this second set showed any evidence of metamorphosis.

In both sets the larvæ reared on wet sand under damp moss grew more slowly than those reared in the water. This may have been due to difficulties of feeding in the terrestrial habitat. These larvæ reared under moss also agree in lacking a tail-fin and in having decidedly shorter tails in proportion to their body-length than the larvæ reared in the water. In the first set of eggs a consistent difference in size between the terrestrial and aquatic larvæ began to appear by June 8. In the second set this difference appeared by June 15. By July 1, a terrestrial larva of the first set measured 11 mm. from snout to cloaca, and 19 mm. in total length. The same day an aquatic larva of this set measured 14 mm. from snout to cloaca and 24.5 mm. in total length. In the second set a terrestrial larva on July 10 measured 11 and 18.2 mm. and an aquatic larva 13 and 23 mm. for the same parts.

The tails of the terrestrial larvæ compared with their total length are proportionately shorter than the tails of larvæ of the same age reared in water. However, the terrestrial conditions have not acted directly upon the tail, stunting its growth. A comparison of the series of larvæ reared on damp sand with the series reared in water shows conclusively that the entire growth of the former series has been checked. The terrestrial larva preserved July 10 is a trifle shorter than an aquatic larva preserved June 15. The apparent stunting of the tail in the older terrestrial larva is due to the fact that the entire growth of the larva has been checked in the terrestrial situation.

At the time of hatching, June 8, the larva measured 9.5 mm. from snout to cloaca and 15 mm. in total length. The increase of 4 mm. in total length which took place in the wet sand habitat during the following month may have been accomplished merely by the absorption of the yolk. However, the young salamander which was preserved April 23, after being reared under wet moss since the preceding October 23, reached a total length of 23 mm. Although its snout was essentially larval in structure, food was contained in the stomach. Unidentifiable fragments of food were also found in the stomachs of the terrestrial larvæ which had metamorphosed by this time and had reached a total length of 25.5 mm. Therefore, it seems highly probable that some food is

eaten by the larvæ when forced to live out of water under damp moss. These larvæ, however, do not attain the size of their brothers or sisters reared in the water.

Although Wilder (1913) was the first to give a detailed description of disproportionate growth of the tail in the larvæ of *D. f. fuscus* we are unable to accept the interpretation she has given to this datum. She states (p. 277):

"The increase in length of the tail is the principal factor in the change in length proportions of the body. These changes in the tail are obviously a preparation for aquatic life which is soon to follow."

We find this more rapid growth of the tail a phenomenon common to many salamanders. It occurs in *Batrachoseps attenuatus* and *Aneides æneus*, which pass their entire life on land and consequently never use the tail as a swimming organ. In fact, Mrs. Wilder has shown that a similar rapid growth in the tail of *D. f. fuscus* occurs also at the time of metamorphosis, when the salamander is preparing itself for what is essentially a terrestrial life. She states (p. 294) in regard to the larva:

". . . the average proportions and size of the body remain practically the same until late spring, when there occurs a marked increase in the average size and a decided change in the proportionate lengths of the regions of the body in that the tail lengthens more rapidly than either the head or trunk."

Wilder compares the development of *D. f. fuscus* with that of *Eurycea bislineata.* The eggs of the latter species are aquatic, poorly provided with yolk, and the larva consequently escapes from the egg-capsules in a more juvenile condition than does *D. f. fuscus.* Wilder assumes that in *D. f. fuscus,* at the time of hatching, the longer hind legs are "undoubtedly accounted for by the demands of this short terrestrial period preceding the aquatic larval life." It may be noted, however, that all Amphibia well provided with yolk tend to hatch in a more mature condition than those poorly provided with this substance. The well-developed condition of *Cryptobranchus* at hatching is not an adaptation to terrestrial life which it never experiences. Similarly the well-developed limbs of *D. f. fuscus* may be looked upon primarily as a consequence of an ample endowment of yolk. Wilder (1913, p. 273) comments further:

"While the limits of the terrestrial larval stage are somewhat indefinite, the structural changes which take place during this period are very important."

For the reasons stated above we are unable to accept the changes in proportion as an adaptation to terrestrial life. Unlike the terrestrial

larvæ of various Salientia such as *Hoplophryne* and *Sooglossus*, the larvæ of *D. f. fuscus*, during their stay on land, show no structural change in the branchial region other than a reduction in length of the gills. Wilder describes the early development of granular glands in the integument as an adaptation to exposure to air. In *Ascaphus*, also, granular glands develop early and the tadpoles of this species are prone to work their way out of water apparently while feeding (Noble and Putnam, 1931). In spite of this possible terrestrial adaptation in *D. f. fuscus*, the terrestrial larva remains primarily adapted for aquatic life.

Wilder (1917, p. 17) remarks "That the terrestrial larval stage is really a definite one is shown by the behavior of the newly hatched larvæ when placed in water . . . they will not remain in the water, but persistently crawl out and lie, often in a mass together, in the moist debris along the edges. It is not until all external evidence of the yolk mass has disappeared that they will remain in the water."

We have found that eggs ready to hatch may be placed in water and the larvæ will emerge normally. From the moment of hatching, our larvæ, as stated above, seemed fully adjusted to the water and made no effort to escape from the dishes. In view of the fact that the eggs of *Desmognathus* are often placed only a few centimeters from the edge of the stream where they would be caught by the rising waters following a heavy rain, it seems highly probable that in nature *D. f. fuscus* must frequently take up at once a larval life in the water. Conversely, other experiments reported above have shown that if the stream bed remains moist but devoid of free water the larva may pass its entire premetamorphic life on land. In brief, our experiments show that the life history of *D. f. fuscus* is more plastic than Wilder assumed on the basis of her observations.

Wilder (1917, p. 18), discussing her two sets of *D. f. fuscus* eggs, remarks: "The period of incubation in both these broods was approximately eight weeks (53–55 days in the first case and 56–57 days in the second), a considerably longer time than that previously estimated by me, which was five weeks."

One set of eggs that was laid in our laboratory April 17 hatched on June 6 to 8. This gives an incubation period of fifty to fifty-two days. But five sets of eggs that were laid June 15, 18, and 22 hatched practically together on July 30 or 31. Probably the laboratory temperatures were higher than those to which the eggs would be subjected near their native brooks. It is apparent that the temperature considerably influences the period of incubation in *D. f. fuscus.*

Wilder (1913) assumed that the mode of life history of *D. f. fuscus* has played an important part in controlling the distribution of the adult. She states (p. 256):

"The element of close proximity to running water in the habitat of *Desmognathus* is certainly not necessary to the immediate physiological demands of the adult, but is incident rather to the aquatic nature of the larval life, which makes necessary not only easy access to water after hatching, but also requires that the supply of water shall be perennial, since each year the newly hatched larvæ reach the water at about the time when the brood of the previous summer leave the water as very small adults."

However, there are various salamanders such as *Ambystoma maculatum* and *Hemidactylium scutatum* that lay eggs in or near the water and yet find it congenial to live at considerable distances from water throughout most of the year. We have presented evidence above that streams are not necessary for the larval life of *D. f. fuscus*. It seems to us that the stream habitat of *D. f. fuscus* is a consequence of adult requirements. In this connection the field observations of one of us appear to be pertinent. It is well known that *D. f. carolinensis* differs from the typical form in its tendency to move away from the stream beds. Although the eggs are laid near streams in the manner of *D. f. fuscus*, the adults may be found shortly after the breeding season at considerable distances from water. They are found under logs in the woods, associated with the various species of *Plethodon*. From August 21 to 28 one of us was collecting in Virginia, western Maryland, and West Virginia The season was dry and most of the *Desmognathus* were near the streams. Occasionally a specimen of *D. f. carolinensis* and one of *D. f. fuscus* would be found together under the same stone, but this was not the rule. The great majority of the several hundred *D. f. carolinensis* taken were found on damp ground at a distance from the stream-beds, while the *D. f. fuscus* were close to the running water. This difference of habitat selection was particularly noticeable at night when, with the aid of electric hand-lamps, both species could be seen wandering about, each tending to keep to its own territory. A particularly favorable spot for demonstrating this habitat difference was the road of Route 50 running west for two miles from Table Rock Inn. The road cuts a series of small streams that seep from the bank along the south side of the road. Here, on two evenings, many *D. f. carolinensis* were seen wandering over the wet stones of the steep bank while the *D. f. fuscus* were at the foot of the bank where the seepage tended to form a stream. While the latter

situation was wetter than the former, it seemed to us that there were mechanical factors that also tended to keep *D. f. fuscus* in its habitat. *D. f. carolinensis* was very agile in running over these wet, vertical surfaces. On the night of August 28, an adult *D. f. fuscus* was seen trying to climb up a vertical bank along the road beyond Table Rock Inn. After climbing about 20 cm. it slipped and fell. It rested about two minutes and tried the climb again. This time it succeeded and slowly worked its way up the vertical bank. When it was approximately half-way up the salamander was touched lightly on the tail. Instead of wriggling off rapidly over the surface of the wall in the manner of *D. f. carolinensis* it fell heavily to the bottom of the bank again. Only on one other occasion was another *D. f. fuscus* seen sticking to this vertical bank. The typical form is heavier than *D. f. carolinensis* and possibly for this reason alone it is unable to work its way rapidly over vertical surfaces. However, very few *D. f. carolinensis* were found in the stream-beds with *D. f. fuscus*. Apparently *D. f. carolinensis* selects damp ground in preference to the immediate vicinity of streams. There is still another reason for habitat segregation: *D. f. fuscus* usually escapes danger by plunging into the stream, while *D. f. carolinensis* when stimulated tends to run rapidly away, seeking for a crevice in which to hide. In brief, apparently there are several factors which tend to isolate these two closely related subspecies during adult life. The mode of life history has played little or no part in this isolation.

D. f. fuscus and *D. f. carolinensis* occur together over a wide area of Virginia, western Maryland, and West Virginia, without intergrading. The ability of *D. f. carolinensis* to live in damp soils at a distance from flowing water has given it a much wider local range than *D. f. fuscus* enjoys. This was clearly brought to the attention of one of us while carrying on field work in this area. For example, near the top of Spruce Knob in West Virginia, at an altitude of 4860 feet, only *D. f. carolinensis* was found on August 26 and 27, 1930. The form was abundant in damp ravines through which mountain streams flowed during most of the year. In the open fields several hundred feet below the top of the mountain there is some seepage from springs. Here, under rocks, another series of *D. f. carolinensis* was taken, but no *D. f. fuscus*. Back Run Creek lies in a valley along the southern edge of the mountain. When this creek was reached, *D. f. fuscus* and *D. phoca* began to appear. Under stones two or three feet from the water approximately 90 per cent of the *Desmognathus* caught were *D. f. carolinensis*. *D. fuscus* was taken in considerable numbers under stones lying on the edge of the stream. *D.*

phoca was caught by turning over the larger stones in the same situation. In this region where *D. quadra-maculatus* does not occur, *D. phoca* was living in the same habitat as *D. f. fuscus* but, in correlation with its larger size, was frequenting larger crannies below the rocks along the edge of the stream. Only once were a *D. phoca* and a *D. f. carolinensis* taken together under the same rock a few centimeters from the water. *D. f. fuscus* and *D. phoca* being of different sizes were living successfully together in the same stream-beds. *D. f. carolinensis* is smaller than *D. f. fuscus* but it avoids competition chiefly by selecting moist ground at a distance from water.

In North Carolina where the large and powerful *D. quadra-maculatus* may come into the picture there is, in certain localities at least, a restriction of adult *D. phoca* to the muddier streams (Noble, 1927). We have found in the laboratory that *D. quadra-maculatus* feeds readily on any small specimens of *Desmognathus*. It has been our custom to keep this species in good health by feeding it on these salamanders alone. On the other hand the cannibalistic habit is not common in the other species, and we have found it advisable to feed them on earthworms. It would be interesting to determine by field experiments how large a part the cannibalistic habit of *D. quadra-maculatus* has played in the disappearance of adult *D. phoca* from certain streams where the former species is abundant.

CONCLUSIONS

1.—The larval life of *Desmognathus fuscus fuscus* is more plastic than has been hitherto assumed.

a. A terrestrial stage may be omitted. Eggs will hatch in water and the larvæ will live from the time of hatching in this medium without endeavoring to escape.

b. An aquatic larval stage may be omitted. Larvæ have been reared from hatching to metamorphosis, in dishes provided merely with damp moss.

2.—Larvæ of *D. f. fuscus* reared under damp moss do not attain the size of their brothers or sisters reared in the water.

3.—A brooding female is attracted by the eggs of its own species and will find and brood the eggs of another female when these are placed in dishes unfamiliar to the salamander.

4.—A brooding female tends to return to the site of egg laying. It will brood artificial eggs placed in this site but not those placed elsewhere in the dishes.

5.—Females which have laid eggs but failed to brood them may later eat these eggs.

6.—*D. f. fuscus* and *D. f. carolinensis* occur together in part of western Virginia, western Maryland, and West Virginia. They avoid competition by selecting different habitats. Their different climbing abilities and their different avoiding reactions, also, tend to keep them apart.

REFERENCES

DUNN, E. R. 1926. 'The Salamanders of the Family Plethodontidæ.' Northampton.

NOBLE, G. K. 1927. 'The Plethodontid Salamanders; some Aspects of Their Evolution.' Amer. Mus. Novitates, No. 249, pp. 1–26.

1931. 'The Hedonic Glands of the Plethodontid Salamanders and Their Relation to Sex Hormones.' Anat. Rec., XLVIII, pp. 57–58.

1931*a*. 'The Biology of the Amphibia.' McGraw Hill, New York.

NOBLE, G. K., AND BRADY, M. K. 1930. 'The Courtship of Plethodontid Salamanders.' Copeia, No. 2, pp. 52–54.

1932. 'Observations on the Life History of the Marbled Salamander, *Ambystoma opacum* Gravenhorst.' (In press.)

NOBLE, G. K., AND PUTNAM, PHILLIPS. 1931. 'Observations on the Life History of *Ascaphus truei* Stejneger.' Copeia, No. 3, pp. 97–101.

NOBLE, G. K., AND WEBER, J. A. 1929. 'The Spermatophores of *Desmognathus* and Other Plethodontid Salamanders.' Amer. Mus. Novitates, No. 351.

WILDER, I. W 1913. 'The Life History of *Desmognathus fusca*.' Biol. Bull., XXIV, pp. 251–342.

1917. 'On the Breeding Habits of *Desmognathus fusca*.' Biol. Bull., XXXII, pp. 13–20.

AMERICAN MUSEUM NOVITATES

Number 534 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | June 3, 1932

59. 57, 7 (7)

NEW AMERICAN DIPTERA

BY C. H. CURRAN

The flies described in the following pages are mostly from Central America but a few occurring in the Nearctic region and in South America have been included in order that the identification of Museum material in genera treated may be complete. In order to show the relationships of the new forms I have prepared keys to the species.

The types are in the American Museum of Natural History.

Stratiomyidæ

MEROSARGUS Loew

In the following key I have included only those species of which there are examples in the Museum collection. In addition to the species included there are six described from Mexico, references to which will be found in the Aldrich Catalogue.

TABLE OF SPECIES

1.—Posterior tibiæ black or brown on almost the whole length, at least on the anterior surface..2.
Posterior tibiæ yellowish on either the basal or apical third or with a very broad pale median band...11.
2.—Mesonotum mostly black, brown, green or bluish.. .... .3.
Mesonotum rusty yellowish, sometimes with dark vittæ........ ... . 10.
3.—Tarsi blackish apically..4.
Tarsi wholly white.......... ....*gowdeyi* Curran.
4.—All the femora entirely black..... ... .*intensicus* Curran.
Femora partly reddish or yellowish.................................. ...5.
5.—Posterior femora black with the apex very broadly reddish. .*fasciatus* Fabricius.
Posterior femora with the apex only narrowly reddish or the base and apex broadly reddish...6.
6.—Mesopleura with a large black spot...............................7.
Mesopleura wholly pale..8.
7.—Anterior tarsi wholly black.......................... ....*anticus*, n. sp.
Basal segments of the anterior tarsi yellowish...................*lutzi*, n. sp.
8.—Face wholly pale yellow.............................*spatulatus* Williston.
Face black or brown on lower half or more..............................9.
9.—Front with an isolated whitish spot on either side..........*festiva* Williston.
Front without isolated whitish spots.................... ...*abana*, n. sp.

10.—Metapleura black. . . . . *rotundatus*, n. sp.
Metapleura pale. . . . . 20.
11.—Front metallic green between the antennæ and the whitish fascia. *cingulatus* Schiner.
Front luteous or yellowish below. . . . . 12.
12.—Mesopleura partly or wholly black or green. . . . . 13.
Mesopleura wholly pale. . . . . 15.
13.—Mesonotum metallic green. . . . . 14.
Mesonotum mostly rusty yellow, the sides black in front. *hyalopterus* Giglio-Tos.
14.—Hypopleura very broadly yellow behind. . . . . *stamineus* Fabricius.
Hypopleura practically all dark, merely with a narrow, pale border. . *elatus*, n. sp.
15.—Posterior tibiæ black, about the median third yellow. . . . . *ethelia*, n. sp.
Posterior tibiæ at least half yellow. . . . . 16.
16.—Posterior tibiæ broadly black-haired basally. 17.
Posterior tibiæ wholly yellow-haired on basal half. . . . . 18.
17.—Scutellar hair wholly black. . . . . *par*, n. sp.
Scutellar hair mostly reddish yellow. . . . . *concinnatus* Williston.
18.—Posterior tibiæ wholly yellow. . . . . 19.
Posterior tibiæ black on apical half. . . . . *bequaerti* Curran.
19.—Front broadly yellow in the middle and behind the ocelli, black on the sides. *pallifrons*, n. sp.
Front metallic greenish above the transverse depression. . *concinnatus* Williston.
20.—Sides of the scutellum black at the base. . . . . *subinterruptus* Bellardi.
Sides of the scutellum not black at the base; abdominal fasciæ entire. *abana*, n. sp.

Merosargus anticus, new species

Black, partly yellowish and reddish; front with two white spots below; anterior tarsi wholly black. Length, 5 to 7 mm.

MALE.—Head black, the face and lowest third of the front yellow, the front with a whitish spot on either side at the upper edge of the yellow ground; sides of the facial depression usually brown. Front with almost parallel sides except below, in the middle of the upper portion with a broad, strong longitudinal ridge that does not reach the ocelli but is represented above and below by a smooth area. Hair short, yellowish, partly black on the ocellar triangle. Proboscis and palpi yellow. Antennæ pale orange, the basal segments with black hair; third segment regular in outline; arista black, the base with short black hair.

Mesonotum, pectus, scutellum and a large spot on the mesopleura, black; humeri and pleura yellowish; the posterior calli and narrow border of the scutellum brownish yellow. Metanotum and metapleura black. Thorax with short yellowish hair, the metanotum and sides of the scutellum black-haired.

Coxæ, trochanters and femora reddish yellow, the posterior coxæ partly brown, the posterior femora black on the basal two-thirds; tibiæ black, the bases broadly reddish yellow above, the apex of the middle pair usually broadly reddish; tarsi black, the basal segment of the posterior pair yellow with brownish apex, the middle pair brownish yellow or pale brownish with lighter base. Hair short, yellowish; black on the anterior tibiæ and tarsi, and on the apical two or three segments of the

posterior four tarsi; brown on the basal half of the middle tibiæ and most of the posterior surface of the posterior tibiæ.

Wings smoky, the veins brown, yellow at the immediate base; third vein with two distinct anterior branches. Squamæ yellowish. Halteres yellowish, the knob brown behind.

Abdomen black, the second and third incisures usually broadly reddish, the first and third each with a small reddish triangle at either end, these fasciæ sometimes reduced to lateral triangles. Hair brown except on the sides. Venter reddish, the fifth and sixth sternites mostly brown; hair yellow on the basal four sternites, blackish on the apical one. Genitalia reddish yellow.

FEMALE.—Front slightly wider and with less pronounced median ridge. Ovipositor reddish yellow, the apical part brown; incisures with only the lateral triangles reddish yellow.

TYPES.—Holotype, male, allotype, female, two male paratypes, Moca Guatalon, Guatemala, 1000 m. (J. Bequaert).

Merosargus lutzi, new species

Black, with rusty reddish-yellow markings; basal segments of the anterior tarsi reddish yellow. Length, 11 mm.

MALE.—Head black, the face and lowest fourth of the front reddish yellow, the front with a white spot on either side at the upper border of the yellow color; cheeks yellow, the lateral slopes of the facial depression brownish. Front with parallel sides on the upper half, slightly wider on the lower half, in the middle above the depression with a very broad, strong, rounded ridge extending to a little in front of the ocelli where it ceases abruptly. Hair very short and yellowish; black and erect on the black part of the front. Proboscis reddish yellow; palpi yellow. Antennæ pale orange, the two basal segments with black hair; third segment regular in outline; arista black, thickened and with short hairs on the basal seventh. Facial orbits very narrowly yellow pollinose.

Mesonotum, scutellum, metanotum and a large polished spot on the mesopleura, black; humeri and posterior calli rusty reddish; pleura, pectus and prothorax, reddish yellow, the anterior half of the neck very pale yellow, almost whitish. Hair yellow, paler on the pleura, the mesonotum with three brown pilose vittæ, the median one broad and entire, the lateral ones much abbreviated in front but extending over the posterior calli on to the corners of the scutellum; metanotum with black hair; apex of scutellum more or less yellowish. the free border brownish; upper edge of mesopleura creamy white.

Coxæ, trochanters, femora and tarsi reddish yellow, the apical two or three tarsal segments somewhat darkened. Posterior femora with the base and apex, and most of the upper surface, blackish; tibiæ blackish, the broad apices of the anterior four and broad base of the front pair reddish. Hair yellow, black on the base, apex and upper surface of the posterior femora, on the broad base and posterior surface of the anterior tibiæ, on the basal two-thirds of the middle tibiæ, on the posterior tibiæ except on the apical third of the anterior surface and on the apical two or three segments of the posterior tarsi.

Wings lightly cinereous, with luteous tinge; veins brown, reddish yellow at the immediate base of the wing. Squamæ reddish yellow. Halteres reddish yellow with the base of the knob black.

Abdomen slightly shining black, the first and second incisures very broadly reddish yellow, the third with an obscure, narrow reddish border and distinct reddish-yellow triangles at either side. Basal three sternites reddish, the apical two black; hair yellow on the basal four sternites, black on the apex of the fourth laterally and on the whole of the fifth. Genitalia reddish yellow.

TYPE.—Male, Tukeit, British Guiana, July 17, 1911 (F. E. Lutz).

Merosargus abana, new species

Mesonotum reddish brown or brownish red; metanotum black; posterior legs black with the first tarsal segment reddish. Length, 6.5 to 8 mm.

FEMALE.—Head black, the lowest fourth of the front and upper third of the face yellowish, the yellow of the front bordered above by a whitish fascia; front very slightly widening anteriorly, coarsely granular, with a median shining vitta which is conspicuously striate. Hair yellowish, black on the black part of the front except at the vertex and immediately in front of the ocelli. Palpi and proboscis reddish yellow. Antennæ dark orange, the basal segments with black hair; third segment broadly excavated at the insertion of the arista; arista black, the base swollen and bearing a few short hairs.

Thorax rusty reddish-yellow, the mesonotum tinged with brown or even pale reddish-brown, with indications of two or four darker vittæ; in the pale form there is a brownish vitta toward either side behind the suture. Mesonotum with short, black hair, the anterior and lateral borders with brownish-red hair, pleural hair yellowish. Metanotum blackish, black haired. Scutellum with yellowish border.

Anterior legs reddish yellow, the coxæ yellowish, the base sometimes broadly brownish, the apical three tarsal segments black. Middle coxæ mostly brownish, the femora brownish red, their tibiæ black or brown on the basal half and brownish red on the apical half, their tarsi brown with the basal segment reddish. Posterior coxæ brown, the legs black, with the basal segment of the tarsi reddish. Hair yellowish, black on the basal half of the middle tibiæ, basal two-thirds of the posterior femora, on their tibiæ except in front, and on the apical three or four segments of all the tarsi.

Wings cinereous hyaline, slightly darkened on the apical half; third vein with two anterior branches. Squamæ grayish yellow. Halteres reddish yellow, the basal half of the knob black.

Basal two abdominal segments reddish, with a blackish fascia occupying a little more than the median third; third segment blackish, with the apical fifth reddish yellow; fourth and fifth segments blackish, the fourth with a yellowish triangle on each corner; ovipositor yellow, the cerci black. The fourth segment may bear a yellowish apical fascia; the entire sides of the abdomen are reddish yellow. Basal two sternites yellow, the apical three brown, with the sides reddish. Hair black, yellow on the sides and on the basal sternites.

TYPES.—Holotype, female, and paratype, female, Sa Emillia, Pochuta, 1000 m., February-March, 1931 (J. Bequaert).

Merosargus rotundatus, new species

Rusty reddish, yellow and black; metapleura with a very large, roundish black spot. Length, 8 to 9 mm.

MALE.—Upper section of the front and the occiput black; the front with parallel sides, widened below the transverse depression and at the vertex, on either side with a narrow, punctate depression, the smooth section with weak, longitudinal striæ. Face,

cheeks, and lower section of the front yellow, the front with a large, subtriangular brown spot on either side below the weak, transverse ridge, the face transversely brown in the middle. Hair yellowish, extremely short and black on the front. Proboscis and palpi yellowish. Antennæ orange, the basal segments with yellow hair; third segment longer than wide, the sides almost rounded, the apex convex; arista brown, with short hairs on the swollen basal part.

Thorax rusty yellowish, the dorsum rusty reddish; the broad sides of the mesonotum except posteriorly, a large spot on the mesopleura above and a very large, roundish spot on the metapleura, shining blackish or brown. Hair on the mesonotum brown, on the scutellum and metanotum, black, on the pleura, yellow.

Legs reddish yellow and yellow; posterior tibiæ black, with reddish apex and very broadly reddish posteriorly; posterior femora brownish on the basal half of the anterior surface, the apical segment of all the tarsi brown. Hair yellow, black on the basal half of the anterior surface of the posterior femora, on the posterior tibiæ with the exception of the apical two-thirds of the posterior surface, and on the apical three segments of all the tarsi.

Wings rather strongly tinged with brown; basal branch of the third vein ending in the costa. Squamæ grayish yellow. Halteres reddish yellow, the basal half of the knob brown.

Abdomen orange, the second to fourth segments each with a large, oval or roundish shining black spot on either side, the fifth segment shining black with the basal sixth and the posterior and lateral margins reddish. Venter and genitalia reddish yellow. Hair black on the dorsum, yellow on the lateral margins, venter and genitalia.

FEMALE.—The black abdominal spots are larger, those on the first segment rectangular, on the second round, on the third transversely oval, on the fourth subrectangular, rounded outwardly, while the fifth segment has the apex narrowly reddish and the black color reaches the sides in almost its full width. Sixth segment reddish, the ovipositor brownish above, reddish below.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, January 5, 1929; allotype, female, Barro Colorado Island, February 16, 1929 (Curran).

This species is related to *subinterruptus* Bellardi but is readily distinguished by the black spot on the metapleura, more elongate third antennal segment the black lateral vittæ on the mesonotum, etc. From *hyalopterus* Giglio-Tos it is distinguished by the black metapleural spot, long basal branch of the third vein, shape of the lateral black mesonotal vittæ and the abdominal markings.

Merosargus elatus, new species

Metallic green and black, with violaceous reflections, the abdomen with yellowish fasciæ, metapleura wholly dark. Length, 6 to 10 mm.

MALE.—Head black, front metallic green, with violaceous reflections; upper half of face and lower section of front brownish yellow, the upper border of the lower section of the front with a narrowly interrupted white fascia. Front narrow, widening below, in the middle with an elongate, tubercular swelling or short, rounded ridge, the sides granular. Hair yellowish, black on the face. Proboscis and palpi yellow. Antennæ reddish yellow, the basal segments black-haired; third segment elliptical, longer than wide; arista black, with short black hairs on the swollen portion.

Mesonotum, scutellum, metanotum and metapleura metallic green, with violaceous reflections; pleura and pectus brownish black, the very broad upper border of the sternopleura and lower part or all of the pteropleura, yellowish, the incisures more or less bordered with brownish yellow; prothorax mostly yellowish. Hair yellowish, black on the posterior third of the metanotum.

Legs reddish yellow; posterior coxæ, posterior femora, except the base, apical half of the posterior tibiæ, the apical three segments of the anterior tarsi and apical four of the posterior tarsi, black or brown. Hair yellow, black on the blackish portions, white on the basal segment of the tarsi and on the posterior tibiæ.

Wings cinereous; veins brown; basal branch of the third vein elongate. Squamæ yellowish. Halteres yellow with the basal half of the knob brown.

First abdominal segment black, with almost the apical third yellow; second segment with the base and apex broadly yellow, the black band very broadly strongly narrowed in the middle, bisinuate anteriorly; third segment similarly marked, the fourth blackish, with the base and apex broadly reddish yellow, the fifth with a basal reddish fascia, sixth wholly dark. The blackish markings are all metallic and show greenish, bluish, and violaceous reflections. Hair black, yellow on the yellow fasciæ except along the broad middle line. Venter yellowish, the fifth sternite blackish on the apical two-thirds except at the tip, the sixth blackish except for a small lateral triangle, the hair concolorous with the integument. Genitalia reddish, the hair black.

FEMALE.—Face wholly brownish; median frontal swelling less developed; mesonotum with brownish hair in the middle anteriorly; pale abdominal fasciæ all narrow. Ovipositor brownish.

TYPES.—Holotype, male, France Field, Canal Zone, January 18, 1929; allotype, female, Corozal, Canal Zone, January 16, 1929. Paratypes: two males, Barro Colorado Island, Canal Zone, January 9 and February 18, 1929 (Curran); male, Teapa, Tabasco, Mexico, January (H. H. Smith, from Williston Collection).

This species is close to *stamineus* Fabricius but may be at once distinguished by the presence of the much stronger longitudinal frontal ridge, very much narrower white frontal fascia on the upper slope of the lower section of the front, absence of a whitish spot on the metapleura, more extensively black tarsi, etc.

Merosargus ethelia, new species

Mesonotum mostly, and the scutellum, green; abdomen with black spots; posterior tibiæ black with a very broad median reddish band. Length, 5.5 mm.

MALE.—Head black; face and cheeks brownish yellow, the facial depression and a narrow fascia immediately above, blackish; lowest fourth of the front brownish yellow, with a broad white fascia above. Front with parallel sides on the upper half, slightly widening anteriorly, finely granular, a median shining vitta and the ocellar region bright green. Hair yellow, black on the middle of the face. Palpi and proboscis yellow. Antennæ dark orange, the basal segments with black hair; third segment longer than wide; arista black, with very short hairs on the base.

Mesonotum and scutellum metallic green, the former with the very broad anterior and lateral margins rusty reddish, the lateral margins with greenish reflections in some lights and becoming quite green posteriorly; metanotum green, the metapleura

violaceous; pleura shining rusty reddish above, becoming reddish yellow on the pectus. Hair yellowish, very pale on the pectus.

Legs reddish yellow, the coxæ and bases of the anterior four femora pale yellow: apical fourth of the posterior femora, basal and apical third of their tibiæ and the apical four segments of the posterior tarsi, black, the apices of the tarsal segments reddish; hair yellow, black on the black portions and on the apical segments of the anterior four tarsi.

Wings cinereous hyaline; first branch of the third vein united with the first vein on its apical third. Squamæ pale grayish-yellow. Halteres pale reddish-yellow.

Abdomen orange and black; the second to fourth segments each bear a very large, rather square black spot on either side while the first and fourth each bear a very large rectangular spot on either side, those on the first segment broadly separated, those on the fifth rather narrowly separated and narrowly connected along the posterior margin of the segment. All the blackish spots reach the lateral margins and all are separated from the anterior and posterior margins of the segments, except that those on the fifth segment extend to the posterior edge; the spots all have a purplish tinge. Venter and genitalia reddish yellow. Hair yellow, black on the black markings.

TYPE.—Male, Barro Colorado Island, Canal Zone, January 28, 1929 (Curran).

Merosargus par, new species

Rusty reddish, the head, abdomen and legs with black markings. Length, 6.5 mm.

FEMALE.—Head yellow, the sides of the occiput, the frontal orbits on the upper two-thirds widening anteriorly, and the ocellar triangle, black, the black ocellar spot connected with the orbital stripe by a brown spot; hair yellowish. Front wide, slightly widened anteriorly, not granulated, the upper section with a very wide longitudinal median groove bounded laterally by a rounded ridge. Palpi, proboscis, and antennæ reddish yellow, the basal antennal segments with yellow hair; third segment a little longer than wide, convex apically; arista brown, the swollen portion yellowish and with a few short hairs.

Thorax rusty reddish yellow, the mesonotum and base of the scutellum with brownish tinge, and black hair; pleura with pale hair; metanotum yellowish brown, black-haired.

Legs reddish yellow, the base of the posterior femora broadly brownish red, the posterior tibiæ brown on almost the basal half; apical four segments of the anterior tarsi and two or three of the middle tarsi brown. Hair yellow, white on the posterior tarsi; base of the posterior femora, basal half of the posterior tibiæ and the dark segments of the anterior four tarsi, black-haired.

Wings cinereous hyaline, the veins yellowish brown; basal branch of the third vein very short, oblique, ending in the first vein. Squamæ yellowish. Halteres reddish yellow, the basal half of the knob brownish.

Abdomen rusty reddish, each segment with a broad, black fascia; that on the first segment basal and not reaching nearly to the lateral margin; that on the second segment lying mostly in front of the middle, produced medianly in front and extending over the lateral margins. The fascia on the third segment lies on the middle of the segment, is similarly produced in the middle, but reaches the lateral margins only obscurely; the bands on the fourth and fifth segments are wider, lie distinctly behind the middle, are more gradually produced anteriorly and do not reach the lateral

margins. Hair black, yellowish on the pale portions of the second and following segments. Venter reddish, the hair yellowish, black on the apical half of the fifth sternite, whole of the sixth and on the ovipositor; ovipositor reddish, the cerci black.

TYPE.—Female, Moca Guatalon, Guatemala, 1000 m. (J. Bequaert).

Merosargus pallifrons, new species

Rusty reddish-yellow, the head and abdomen with black markings; posterior tibiæ wholly yellowish and with yellow hair. Length, 8.5 mm.

MALE.—Head yellow, the front somewhat darker; occiput black on the sides; front with a broad black stripe on either side extending from a little below the middle to opposite the anterior ocellus, where the lateral bands are connected by a brown spot to the black ocellar triangle; middle of the front gently convex, grooved in the middle above the transverse depression. Front narrowest at the middle, slightly widening above, the sides gently concave, widest immediately below the transverse groove, thence gently narrowing to the lower margin. Palpi and proboscis reddish yellow. Antennæ reddish yellow, the basal segments with yellowish hair, the third segment wider than long, gently convex apically; arista brown, the base obscurely yellowish, the swollen part bearing a few short hairs.

Thorax yellowish, the mesonotum slightly darker. Hair yellow, the mesonotum with a broad median vitta and the lateral margins behind the suture black-haired. Metanotum brownish yellow, black-haired.

Legs reddish yellow, the apical three tarsal segments brownish and bearing black hair, the second segment of the anterior tarsi darkened and with black hair; hair on femora, tibiæ and basal tarsal segments yellow.

Wings with luteous tinge, somewhat grayish on the apical half; basal branch of the third vein very short, almost transverse. Squamæ luteous, with brownish border. Halteres yellowish, the basal half of the knob brown.

Abdomen rusty reddish-yellow and blackish. First segment yellowish with a transverse brown spot on the median third of the basal half; second similar but the spot is narrower; third yellowish with a very broad brownish fascia extending over the middle but not reaching the lateral margins; fourth with a little more than the median third blackish; fifth and sixth segments wholly black. Hair black, rich yellow on the very broad apices of the second to fourth and very broad bases of the third to fifth segments. Venter yellow on the basal half, black apically, yellow haired on the first three sternites, broad border of the fourth and broad base of the fifth. Genitalia reddish yellow.

TYPE.—Male, Barro Colorado Island, Canal Zone, January 4, 1929 (Curran).

Lonchæidæ

LONCHÆA Fallen

A key to the described Central American species belonging to this genus is given below. Several species described from South America are not recognizable, as the most important characters by which they may be separated are not mentioned.

TABLE OF SPECIES

1.—Posterior tarsi wholly black or brownish... ....4.
Basal one or more tarsal segments of the posterior legs reddish yellow. ......2.
2.—Wings cinereous hyaline, the veins largely yellowish......... ....3.
Wings wholly yellowish.............. ....*luridipennis*, n. sp.
3.—Third antennal segment three times as long as wide... ....*trita*, n. sp.
Third antennal segment not twice as long as wide (Nicaragua)..*bakeri* Malloch.
4.—Wings wholly cinereous hyaline........ ....7.
Wings with the apical half or more brown...............................5.
5.—Wings wholly brownish........... ....*fuscipennis*, n. sp.
Wings cinereous or cinereous yellow basally, almost the apical half brown....6.
6.—Scutellum with many hairs on the sides.... ....*dimidiata*, n. sp.
Scutellum bare except for the four bristles....... ....*ceres*, n. sp.
7.—Front with broad, irregular, transverse wrinkles...............*duida*, n. sp.
Front without wrinkles..... . ...8.
8.—Front of male twice as long as wide...... ....9.
Front of male only one-half longer than wide (Barbados)... *nigrocœrulea* Malloch.
9.—Thorax metallic blue.............. ....*batesi*, n. sp.
Thorax black with slight bluish tinge (Brazil)................*major* Malloch.

Lonchæa trita, new species

Tarsi yellowish with the apical three segments blackish; no hairs surrounding the stigmatal bristle; wings cinereous hyaline. Length, 3.5 mm.

FEMALE.—Head black, the face with cinereous pollen. Front rather dull black, the sides polished above, one-third longer than wide, narrowing anteriorly, sparsely short-haired. Palpi very broad, black. Antennæ longer than the face, the third segment three times as long as wide, broadly reddish below on the basal third; arista sparsely short pubescent, obscurely reddish basally.

Thorax shining black, the hair short; no hairs surrounding the stigmatal bristle. Scutellum bare except for a pair of marginal hairs before the apical bristles and a pair of hairs between them.

Legs dark brown, the basal two tarsal segments reddish yellow. Middle femora with a row of rather weak posteroventral bristles and a weaker row on the anterior surface; posterior femora without distinct bristles.

Wings cinereous hyaline, the base whitish, the veins yellow. Squamæ and fringe whitish. Halteres black.

Abdomen blackish, the sides very broadly metallic bluish. Basal segment of the ovipositor wider than long.

TYPE.—Female, Patilla Point, Canal Zone, January 15, 1929 (Curran).

Lonchæa luridipennis, new species

Black; tarsi yellow basally, wings wholly yellowish; no hairs surrounding the stigmatal bristle; scutellum without hairs. Length, 4 mm.

FEMALE.—Front three-fourths as wide as long, slightly narrowed above, shining black, sparsely haired in the middle; lunule hidden. Face with cinereous pollen. Cheeks with four or five bristles in addition to the coarse hair. Palpi black, very

broad. Antennæ black, not as long as the face; third segment not twice as long as wide; arista evidently bare, broadly yellowish basally.

Thorax shining black; mesonotum with short, appressed bristly hair ; mesopleura with bristles only; no hairs surrounding the stigmatal bristle; scutellum bare except for the usual four bristles.

Legs blackish, the basal two tarsal segments reddish yellow. Anterior femora with numerous bristles behind; middle femora with a row of anterior bristles and a weaker row behind.

Wings wholly yellowish, the veins yellow. Squamæ and fringe yellow. Halteres black.

Abdomen shining black, with black hair.

TYPE.—Female, Mt. Duida, Venezuela, November 4, 1928 (C. H. H. Tate), No. 99.

The specimen is somewhat moldy but it is so distinctive that I have no hesitation in describing it.

Lonchæa duida, new species

Shining black, the sides of the abdomen rather bluish; legs wholly black; squamæ grayish, with brown border and fringe. Length, about 4 mm.

FEMALE.—Face with cinereous, the occiput and vertex with thin brownish pollen. Front rather shining, the usual polished areas not clearly defined, the anterior three-fifths with irregular, broad transverse grooves, the hair abundant and erect; lunule haired. Cheeks without bristles. Palpi blackish, very broad. Antennæ black, shorter than the face, the third segment less than twice as long as wide; arista black, bare, the immediate base thickened.

Thorax shining black, the dorsum very thinly brownish pollinose; hair moderately long; scutellum wholly without hairs; no hairs surrounding the stigmatal bristle.

Legs blackish; middle femora with row of anterior and posterior bristles toward the lower edge.

Wings cinereous hyaline; base of wing not yellow, the veins mostly reddish yellow. Squamæ grayish, with brown border and fringe. Halteres black.

Abdomen shining black, the sides broadly with green or blue reflections; sternites black. Hair black.

TYPE.—Female, Mt. Duida, Venezuela, January 16, 1929 (C. H. H. Tate), No. 518.

Lonchæa batesi, new species

Legs wholly black; squamæ white, the cilia at the outer side very long and black; abdomen blue with a very broad median bronze vitta. Length, 4.5 to 5 mm.

MALE.—Head black; face cinereous pollinose; sides of front blue above. Front almost twice as long as wide; frontal lunule with strong, stout setæ; cheeks with several bristly hairs. Palpi broad, black. Antennæ brown, longer than the face, the third segment four times as long as wide; arista plumose, yellow basally.

Thorax blue, the mesonotum very thinly brownish pollinose on the disc; hair wholly black. Hair abundant, coarse on the mesopleura; no hairs surrounding the stigmatal bristle; a pair of hairs between the apical scutellars.

Legs brown; middle femora with a row of long posteroventral bristles occupying practically the whole length; posterior femora with a row of short anteroventral bristles.

Wings cinereous hyaline, the base broadly pale yellow, the veins yellow on the basal half of the wing, some of them, including the costa, wholly yellowish. Squamæ white, with white fringe, the outer end with long black cilia. Halteres brown.

Abdomen blue, about the median third of the dorsum bronzed, the sternites brown. Hair black.

FEMALE.—Front wider, five-eighths as wide as long. Ovipositor much narrower than the front, yellowish apically.

TYPES.—Holotype, male, and allotype, female, Escuintla, Guatemala, 1100 ft. (Marston Bates), reared from mangos, *Mangifera indica*, in association with *Anastrepha ludens* Loew. Paratypes: male, Escuintla, May 10, 1931; two males and one female, Antigua, Guatemala, March 24, 25, 1931 (Bates), reared from seedpods of *Inga* species bought in Antigua market, associated with *Anastrepha* species.

This species traces to *vaginalis* Fallen in Malloch's key (Proc. U. S. N. M., LXV, Art. 12, pp. 3–5) but differs in color and the presence of black cilia on the squamæ. It is more closely related to *major* Malloch but the blue color separates it. From *nigrocoerulea* Malloch it is distinguished by its longer front.

Lonchæa dimidiata, new species

Wings brown on almost the apical half, pale basally; legs black; no hairs surrounding the stigmatal bristle. Length, 5.25 mm.

MALE.—Head black; face with cinereous pollen; front rather dull, the sides polished above, the hair sparse. Cheeks scarcely visible from lateral view. Palpi black, very broad. Antennæ blackish, the base of the third segment and very broad base of the arista reddish; third segment four times as long as wide; arista plumose.

Thorax shining greenish black, the dorsum very thinly brownish pollinose. Hair abundant, short and coarse, scutellum with the sides haired and a pair of hairs between the apical bristles; no hairs surrounding the stigmatal bristle.

Legs blackish; middle femora with row of bristles in front and behind; posterior femora with poorly defined bristles in front but with three strong anterodorsals near the apex.

Wings grayish, with the apical portion brown; the brown color is bordered on the inner edge by a line drawn from the apex of the first vein to the posterior end of the posterior cross-vein and also extends along the front border of the costal cell although it may be paler in this cell. Veins yellow on basal portion of wing. Squamæ and fringe white, the outer corner with long black cilia. Halteres brown.

Abdomen shining black, the disc thinly brown pollinose and rather dull. Sternites brownish. Hair and bristles black.

FEMALE.—Front three-fifths as wide as long; first segment of the ovipositor short and broad.

TYPES.—Holotype, male, Barro Colorado Island, Canal Zone, November 10, 1930 (H. F. Schwarz); allotype, female, Mt. Duida, Venezuela, March 6, 1929 (C. H. H. Tate), No. 866.

Lonchæa ceres, new species

Wings luteous and pale brown; no hairs surrounding the stigmatal bristle; frontal lunule haired to lower level of antennæ; squamæ white. Length, 5.5 mm.

MALE.—Head greenish black, the occiput and upper third of the front black; face cinereous pollinose. Front two-fifths as wide as long, the sides diverging below and gently widening above; hair abundant and erect, moderately long. Cheeks with a strong bristle near the middle, the oral margin with two or three below the vibrissæ. Palpi black, very broad. Antennæ black, shorter than the face, the third segment only one-half longer than wide; arista short plumose, yellowish basally.

Thorax shining black, with short, erect hair. Scutellum bare except for the usual four bristles. No hairs surrounding the stigmatal bristle.

Legs blackish or brown, the basal segment of the anterior tarsi yellowish, the first segment of the middle tarsi mostly reddish. Middle femora with row of bristles in front and behind; posterior femora without strong bristles.

Wings luteous on more than the basal half, the apex beyond a line drawn from the apex of the first vein to a point well before the posterior end of the posterior cross-vein, strongly brownish; base of the wings not strikingly yellowish, the veins yellow on the basal half. Squamæ yellow, with reddish yellow border, the fringe yellow. Halteres black.

Abdomen shining black, the dorsum of the basal two segments brownish. Sternites brownish, thinly pollinose, wide. Hair black, the bristles not strong.

TYPE.—Male, Corumba, Brazil, May (Williston Collection).

Lonchæa fuscipennis, new species

Wings grayish brown, paler behind; no hairs surrounding the stigmatal bristle; legs blackish. Length, 5 mm.

MALE.—Head black, face with cinereous pollen, the cheeks and occiput very thinly gray pollinose. Front opaque black, the sides shining above, scarcely half as wide as long, narrowing anteriorly, with rather abundant and fairly long hair. Cheeks scarcely visible from lateral view. Palpi black, broad. Antennæ black, longer than the face, the third segment more than four times as along as wide; arista very broadly yellowish basally, pubescent.

Thorax shining black, the dorsum appearing brown from anterior view; hair fairly long and abundant. No hairs surrounding the stigmatal bristle. Scutellum with numerous marginal hairs and a pair between the apical bristles.

Legs blackish; middle femora rather closely ciliate posteriorly toward the lower edge, with a row of poorly differentiated bristles in front; posterior femora without strong bristles.

Wings grayish brown, paler behind on the basal half. Squamæ grayish yellow, the border of the upper lobe brown, the fringe yellow with long black hairs on the outer portion. Halteres brown.

Abdomen brownish black with the sides and apex very broadly shining black. Venter brown, with brownish pollen. Hair black, no bristles.

TYPE.—Male, Barro Colorado Island, Canal Zone, February 13, 1929 (Curran).

Tachinidæ

Bucentes Latreille

I use this name in place of *Siphona* Meigen as there is a great deal of doubt as to the proper application of *Siphona*. In his original diagnosis Meigen named *Stomoxys irritans* Fabricius as the type of his genus. *Stomoxys irritans* Fabricius is considered a synonym of *Hæmatobia stimulans* Meigen and if we accept the ruling that the naming of the type by Meigen fixes *stimulans* (*irritans* Fabricius, not Linnæus) as type of the genus, *Hæmatobia* must be replaced by *Siphona*. On the other hand Meigen mentions the geniculate proboscis which proves that he did not have *irritans* Fabricius before him, and if we take the view, which I believe to be logical, that the named genotype must possess the characters attributed to the genus, we can accept *Siphona* as applying to the present genus. However, I leave the question to be decided later and use *Bucentes* Latreille, as that leaves no doubt as to the species that should be included.

The genus *Phantasiosiphona* Townsend[1] appears to be the same as *Bucentes* and I doubt if his species, *tropica*, is distinct from *futilis* Wulp. The genus seems to be based on the length of the aristal segments and this character is certainly of not more than specific importance in this group. I present a key to the North American species.

Table of Species

1.—Abdomen destitute of pollen. ....*brevirostris* Coquillett.
Abdomen pollinose..... .... .2.

2. ·Mesonotum vittate...... .. .. .6.
Mesonotum not vittate. .. ..3.

3.--Apical segment of the arista little more than twice as long as the preceding segment[2]......... ....4.
Apical segment of the arista at least three times as long as the preceding segment.............. ....5.

4. Second abdominal segment with two median posterior black spots.
tropica Townsend.[3]
Second segment with a single blackish spot .. ..*futilis* Wulp.

5.--Four pairs of postsutural dorsocentrals; abdomen largely yellowish in ground color........ ....*cristata* Fabricius.
Three pairs of postsutural dorsocentrals; abdomen wholly black in ground color. *intrudens*, n. sp.

6.—Mesontom with four blackish vittæ anteriorly.. ....*diluta* Wulp.
Mesonotum with three sharply defined brownish vittæ...... . .ceres, n. sp.

[1] 1915, 'Ins Ins. Mens.,' III, p. 93.
[2] I am unable to include *plusiæ* Coquillett, as the lengths of the aristal segments are not given.
[3] *Phantasiosiphona*. I doubt if this species is distinct from *futilis*, as there is practically nothing in the description to indicate real differences.

Bucentes ceres, new species

Readily distinguished from other American species by the presence of three incomplete brown vittæ on the mesonotum. Length, 4.5 to 5 mm.

Female.—Face and cheeks yellow, white pollinose; frontal vitta reddish, somewhat darkened above; parafrontals and occiput blackish in ground color, the former and the posterior orbits yellow pollinose, the occiput with white pollen; six pairs of frontals, the upper pair reclinate and divergent; two pairs of orbitals; ocellars long. Front almost as wide as greatest width of eye, gently widening anteriorly. Occiput with whitish hair below the neck. Cheeks one-fourth as wide as eye-height, black-haired. Parafacials narrowing below. Apical section of the proboscis a little longer than the preceding section; palpi yellow, cylindrical. Antennæ black, the basal segments brown; third segment with almost parallel sides, rounded off apically below, the upper apex sharply rounded; arista thickened on the basal two-fifths, the penultimate segment about one-fourth as long as the apical segment.

Thorax black in ground color, cinereous pollinose, the mesonotum with three rather narrow, incomplete brown vittæ, the bristles and hairs mostly arising from brown spots; three pairs of postsutural dorsocentrals. Apex of the scutellum yellow, the basal corners brown, each hair and bristle arising from a brown spot; three pairs of strong marginals and usually a pair of bristly hairs between the apicals, the sides of the scutellum haired. Three sternopleurals.

Legs reddish, the tarsi, posterior four coxæ and the immediate base of the anterior pair black, the coxæ cinereous pollinose; posterior femora with a large brown spot above before the apex.

Wings cinereous hyaline; veins at the base of the wing yellowish; third vein bristled on the base almost to the anterior cross-vein which is situated at the basal two-fifths of the discal cell; bend of fourth vein broadly rounded. Squamæ whitish, with yellowish tinge apically. Halteres reddish yellow.

Abdomen black in ground color, cinereous pollinose, the disc more or less brown, all the hairs and bristles arising from brown spots. First segment without median marginals, the second with one pair, the third and fourth each with a row. Under surface of the abdomen colored as above except that the inner borders of the first tergite are more or less broadly yellowish.

Types.—Holotype and three paratypes, all females, Finca Pintado, Antiqua, Guatemala, parasitic on noctuid larva feeding on alfalfa (Marston Bates).

Bucentes intrudens, new species

Related to *cristata* Fabricius, but the abdomen is black in ground color and there are only three pairs of postsutural dorsocentral bristles. Length, 4.5 mm.

Male.—Face, cheeks, and lower part of the occiput yellow in ground color, white pollinose; parafrontals and occiput black in ground color and with yellowish or brownish-yellow pollen; frontal vitta reddish, twice as wide as the parafrontals combined; seven pairs of frontals and two pairs of orbitals. Cheeks a little more than one-fourth as wide as the eye-height, the bristles black. Occiput with whitish hair below the neck. Proboscis reddish and reddish brown, the two apical sections of equal length; palpi reddish yellow, cylindrical. Basal antennal segments reddish, the third black, almost three times as long as wide, the lower apical corner very

broadly rounded, the upper apex rather sharply rounded; penultimate segment of the arista one-third as long as the apical segment.

Thorax black in ground color, cinereous pollinose, the mesonotum with three more or less fused brownish vittæ, but not conspicuously vittate. Scutellum with the tip obscurely yellowish; three pairs of marginal bristles and a pair of hairs between the apicals; sides of scutellum haired. Three pairs of postsutural dorsocentrals.

Legs reddish yellow, the tarsi black; posterior femora with a large apical brown spot above; posterior four coxæ reddish, with cinereous pollen.

Wings cinereous hyaline; third vein bristled from the base almost to the anterior cross-vein which is situated at the basal two-fifths of the discal cell; bend of fourth vein very broadly rounded. Squamæ whitish; halteres yellow.

Abdomen black in ground color, the tips and inner edges of the tergites yellow, the hairs and bristles each arising from a brown spot; first segment without median marginals, the second with one pair, the third and fourth each with a row. Genitalia brown.

FEMALE.—Proboscis brown, the apical section a little longer than the preceding section; frontal vitta reddish yellow; third antennal segment narrower and shorter; mesonotum almost uniformly cinereous, the disc slightly darkened. Middle and posterior coxæ mostly black in ground color. Brown spots surrounding the bristles larger and forming interrupted fasciæ on the third and fourth abdominal segments.

TYPES.—Holotype, male, and allotype, female, Castle Rock, Pa., April 7, 1908 (A. J. Weidt).

AMERICAN MUSEUM NOVITATES

Number 535 Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City June 6, 1932

59.9,31 O (67 5)

THE AARDVARK OF THE HAUT-UELE[1]

BY ROBERT T. HATT

Of the thirteen aardvarks collected by the American Museum Congo Expedition, two from the forest at Niapu are apparently very close to the type of *Orycteropus erikssoni* Lönnberg from the lower Bomu River. Eleven others from the savannas about Faradje differ from these forest specimens sufficiently to warrant their receiving recognition as another subspecies. Full consideration of the variability and the non-diagnostic characters exhibited by this series will be published in a bulletin on the Tubulidentata and Pholidota of the Congo Expedition, manuscript for which has been completed. The savanna race may be known as follows:

Orycteropus erikssoni faradjius, new subspecies

TYPE.—American Museum of Natural History No. 51373. American Museum Congo Expedition No. 1200, adult male, skin and skeleton. Collected at Faradje, Haut-Uele, Belgian Congo, January 14, 1913, by Herbert Lang.

DIAGNOSIS.—A large aardvark resembling *erikssoni* of the forested regions of the upper Congo, but differing externally from the latter in its slightly smaller size, longer ears, and shorter front claws. The skull differs from that of *erikssoni*, as represented by two specimens from Niapu and the type description, in the following features: the inflation of the region of the frontonasal suture is more pronounced and in consequence the upward curve of the posterior part of the nasals is greater. The nasal region is also broader, to the extent that the greatest width of the combined nasalia is more than one-half the length of the nasal suture. The lacrymal bone of *faradjius* is comparatively long and the length of its suture, shared with the frontal anterior to the orbit, is about 70 per cent of the total length of the lower frontal border between the orbit and the posterior external angle of the nasal. In *erikssoni* the lacrymal-frontal suture is 60 per cent, or less, of the length of the lower frontal border. The zygomatic arch at the level of the end of the zygomatic process of the maxillary is broad (over 20 mm.), while in *erikssoni* the arch is very narrow, measuring less than 20 mm.

The mandible of *faradjius* is more massive and broader, and the angular and coronoid processes are higher than in *erikssoni*. The greatest height of the mandible equals about 45 per cent of its greatest length in the race from Faradje, whereas in *erikssoni* this height is only 39 per cent of the length. The greatest breadth of the mandible in the former race is contained in the mandibular length 4.8 times, whereas in the latter race the length is near 5.5 times the breadth. The tip of the angular process lies midway between the alveolar plane and the articular process, whereas in

[1]Scientific Results of the Congo Expedition, Mammalogy, No. 11.

the larger forest form it is much lower, the height above the alveolar level being only about one-half the distance from the tip of the angular process to the tip of the articular.

MEASUREMENTS.—Collector's measurements of the type specimen are: total length, 1750 millimeters; tail length, 610; length of hind foot, with claw, 270. On the tanned skin the ear measures 120 from the notch to the tip, and the claw of the third front digit is 42 from the eponychium to the tip. Skull measurements of the type are: greatest length, 255; greatest breadth, 98; basal length, 240; palatal length, 159; breadth of palate at M^2, 40; length of nasal suture, 94; breadth of both nasals, 60; breadth between tips of postorbital processes, 71; least breadth of brain-case, 55; greatest breadth of occipital bone, 72; depth at level of pmx-max-nasal suture, 33; depth at nasofrontal suture, 58; greatest width of zygoma, 27. $Molar^1$: length, 10.0; width, 6.4. M^2: length, 12.0; width, 8.2. M^3: length, 10.2; width, 8.0. Greatest length of mandible, 212; greatest width of mandible, 45; width of mandible behind last molar, 24.

AMERICAN MUSEUM NOVITATES

Number 536 | Published by The American Museum of Natural History New York City | June 6, 1932

56.1 (82.9)

FOSSIL PLANTS FROM CHUBUT TERRITORY COLLECTED BY THE SCARRITT PATAGONIAN EXPEDITION[1]

By Edward W. Berry

Last November Dr. George Gaylord Simpson forwarded to me for study the fossil plants collected by the Scarritt Patagonian Expedition. These comprised five small lots from southern Chubut Territory and are not only few in number, but in a very poor state of preservation.

Two lots came from the Upper Cretaceous Salamanqueano series at Cerro Abigarrado south of Lago Musters (field number P1) and Estancia Las Violetas, west of Bustamante (field number P2). The former contains several small lanceolate dicotyledonous leaves with unobservable venation and wholly lacking generic characteristics. The latter contains silicified coniferous wood and the fragment of a medium-sized dicotyledonous leaf that seems clearly to belong to the family Lauraceæ, although it is generically undeterminable. The remaining three lots contain material not quite so indefinite and worthy of being placed on record.

Field number 417 represents specimens found in digging a well between the Río Chico and the coast near Cañadón Hondo, which enters Río Chico near Paso Niemann. The well starts about 65 meters below the level of Pampa Castillo on the Patagonian horizon, and the fossil plants come from a depth of 35 to 37 meters. The matrix is a gray, rather friable tuff, and the specimens were presented to the Scarritt Patagonian Expedition by Juan Roux. The species represented are *Nothofagus simplicidens* Dusén (Amer. Mus. No. B–16), *Nothofagus densinervosa* Dusén, *Fagus subferruginea* Dusén (Amer. Mus. No. B–17) and *Laurelia amarillana* Berry (Amer. Mus. No. B–18).

Field number 421 is a group of impressions found in laminated clays in Cañadón Hondo, and the beds are said to represent the *Notostylops* horizon.[2] The plants represented include numerous leaves of *Embothriophyllum dubium* Dusén (Amer. Mus. No. B–6), a single fragment of a leaf (Amer. Mus. No. B–5) which is the same as *Phyllites* 3 Dusén from the Seymour Island Tertiary, and a winged seed (Amer. Mus. No. B–4)

[1]Publications of the Scarritt Patagonian Expedition, No. 3.
[2]Exact stratigraphic data will be given in a later paper by Simpson.

probably from the same plant as the leaves referred to *Embothriophyllum* and belonging to the family Proteaceæ, which is described on a subsequent page as a new species of the genus *Embothrites* of Unger.

Field number 455, which is from the same locality as number 421 and collected about a month later, furnishes *Scirpites* sp. Dusén (Amer. Mus. No. B–11), *Rhoophyllum nordenskjöldi* Dusén (Amer. Mus. No. B–9), *Embothriophyllum dubium* Dusén (Amer. Mus. No. B–7), *Knightia andreæ* Dusén (Amer. Mus. No. B–8), and *Phyllites* 2 Dusén (Amer. Mus. No. B–2).

Field number 455A was found near 455 and about 10 feet higher. It furnishes several varieties of undeterminable dicotyledonous leaves, fragments of leaves of some grass or sedge (Amer. Mus. No. B–13), and a fragment of *Embothriophyllum dubium* Dusén (Amer. Mus. No. B–14).

The result is a small list of species definitely from beds which are mammal-bearing and represent the *Notostylops* and perhaps the *Pyrotherium* horizons, and all species are also found at other localities either near Lago Nahuel Huapi,[1] Punta Arenas on the Straits of Magellan,[2] on the coast of Tierra del Fuego,[2] or on Seymour Island on the coast of Graham Land,[3] but in these other localities not associated with mammals.

They are thus of very considerable geological importance and palæobotanical interest, despite their small number, poor preservation, and somewhat vague systematic position.

This list comprises:

Scirpites sp. Dusén
Grass or sedge leaves
Embothriophyllum dubium Dusén
Embothrites, n. sp.
Rhoophyllum nordenskjoldi Dusén
Knightia andreæ Dusén
Phyllites 2 Dusén
Phyllites 3 Dusén
Nothofagus simplicidens Dusén
Nothofagus densinervosa Dusén
Fagus subferruginea Dusén
Laurelia amarillana Berry

The last four species which were included under field number 417 have not been encountered at the localities of numbers 421, 455 and 455A,

---

[1]Berry, Edward W. 1928. "Tertiary Fossil Plants from the Argentine Republic," U. S. National Museum Proc., LXXIII, Art. 22.

[2]Dusén, P. 1899. "Über die tertiäre Flora der Magellansländer," Svenska Exped. Magellansland, Bd. 1, No. 4. Gilkinet, A. 1909. "Quelques plantes fossiles des terres Magellaniques." Resultats voyage du S. Y. Belgica en 1897, 1898, 1899.

[3]Dusén, P. 1908. "Über die tertiäre Flora der Seymour-Insel," Wiss. Ergeb. Schwed. Südpolar-Exped. 1901–1903, Bd. 3, Lief. 3.

and there is some evidence that the horizon of number 417 is slightly younger than the other two localities. This evidence consists in the presence of *Laurelia amarillana*, elsewhere known from Rio Chalia in Santa Cruz Territory associated with a flora which seemed to me to be distinctly younger than the *Fagus* zone, if the latter be assumed to have a precise stratigraphic significance, which is not certain. This would place it above the Magellanian marine transgression and at approximately the horizon of the *Araucaria* zone, assuming again that the latter has a precise stratigraphic significance, which again is not certain. In terms of the Patagonian mammalian succession, this would make number 417 a possible correlative of the *Pyrotherium* (Deseado) horizon, which I would regard as upper Oligocene or lower Miocene. The mammals which the Scarritt Patagonian Expedition collected at the horizon of the plants under number 417 may be expected to settle the question of whether the horizon is *Notostylops* or *Pyrotherium* and thus clear up part of this palæobotanical uncertainty, although the fact that this lot was found in a well at some distance from corresponding surface exposures introduces a further stratigraphic difficulty.

The other floras with which any of these fossil plants can be compared are those from the Arauco district of Chile, which I have regarded as lower Miocene,[1] and that described by me from Mirhoja in Chubut Territory,[2] which I regarded as Santa Cruz in age, i.e., later than the Patagonian marine transgression.

The chief reason for caution in accepting the foregoing as final is the fact that the other species associated with the *Laurelia* under number 417 occur in the territories of Rio Negro, Magellanes and Tierra del Fuego in what have the appearance of being *Fagus* zone associations.

The distribution of the plants in the present collection is shown in the table on page 4. It seems clear from the table, and from the distribution of all of the fossil species from southern South America and Graham Land, that the so-called *Fagus* zone and *Araucaria* zone are not very different in age or in ecologic significance, although Dusén regards the latter as considerably younger and indicative of a milder climate. Gilkinet considered the Baguales florule as younger than the other Magellan florules and emphasizes the recent aspect of the plants from all of these localities. This is an illusion due to the fact that the Eogene climatic conditions from about Latitude 40° southward to

[1]Berry, Edward W 1922. 'The Flora of the Concepcion-Arauco Coal Measures of Chile," Johns Hopkins University Studies in Geology No 4

[2]Berry, Edward W 1925. A Miocene Flora from Patagonia Idem. No 6.

	Río Negro Territory		Chubut Territory				Magellan Territory			Tierra del Fuego		
				Notostylops beds								
	Near Bernal S. E. of Barriloche	Río Nirihuano 4 leagues south of Lago Nahuel Huapí	No. 417 ?*Pyrotherium* beds	No. 421	No. 455	No. 455A	Río de las Minas near Punta Arenas	Baguales	Cabeza del Mar	Barrancas de Carmen Sylva	Río Condor	Seymour Island, Graham Land
Embothriophyllum dubium				×	×	×	×					
Embothrites simpsoni				×								
Fagus subferruginea	×		×				×		×	×		
Knightia andreæ					×							×
Laurelia amarillana			×									?
Nothofagus densinervosa			×						×	×	×	
Nothofagus simplicidens		×	×				×	×		×	×	?
Phyllites 2					×							×
Phyllites 3				×								×
Rhoophyllum nordenskjoldi					×		×					
Scirpites sp.		×			×							×

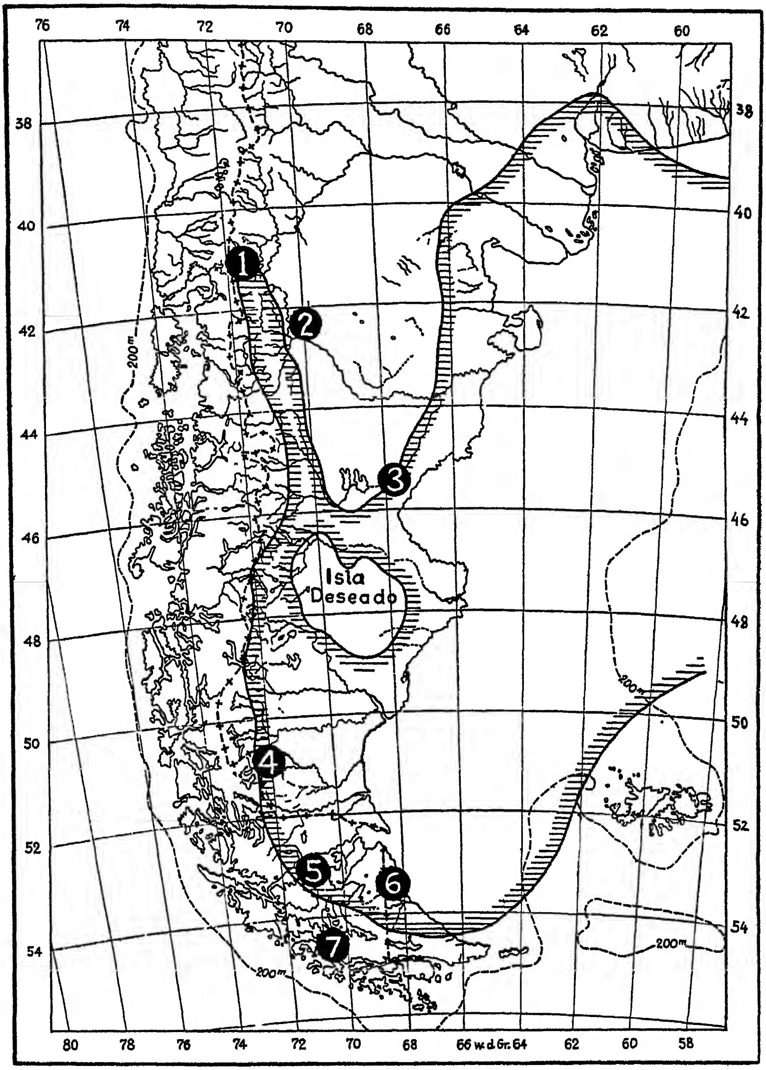


Fig. 1. Tertiary plant localities in Patagonia, on base map showing Patagonian marine transgression by Windhausen.

1. Lago Nahuel Huapí.
2. Mirhoja.
3. Scarritt Patagonian Expedition localities in Cañadón Hondo.
4. Río Chalia region.
5. Punta Arenas, Cabeza del Mar, etc., on Straits of Magellan.
6. Barrancas de Carmen Sylva.
7. Baguales, etc.

Graham Land were somewhat similar to those which exist to-day in southern Chile and that the present survivors occur in the same general region. It was not clear from the studies of Engelhardt, Dusén, Hatcher, and Gilkinet in the Straits of Magellan region just where the *Fagus* and *Araucaria* zones belonged in the general Tertiary section of Patagonia,

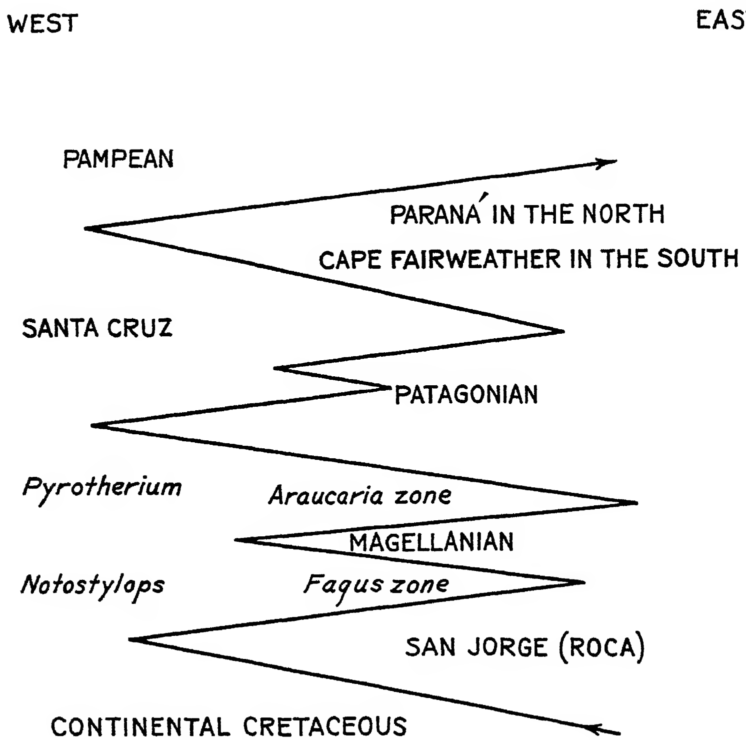


Fig. 2. Diagram of the movement of the strand line in Patagonia during the Tertiary.

but my studies of the florules from the Lago Nahuel Huapi region and of those collected by the Scarritt Patagonian Expedition show that all these flourished previous to the Patagonian marine transgression and are therefore pre-Miocene.

Moreover, the presence of a different flora at Mirhoja and in the Rio Chalia region (Localities 2 and 4 on the accompanying sketch map, Fig. 1) shows that this region, at least between Latitudes 42° and 51°

South, was occupied subsequent to the Patagonian transgression by a more varied and milder climate flora, quite different from the earlier *Fagus-Araucaria* floras, one whose descendants do not extend south of the Argentine Mesopotamia at the present time, at least east of the Andes. I am reproducing in the accompanying text figure (Fig. 2) my conclusion regarding the relations of the various formational units with reference to movements of the strand line. This does not differ from the diagrams published in 1921 and 1925 except that the standard names Eocene, Oligocene, etc., are omitted, since it is possible that the San Jorge (Roca) marine transgression may have been late Cretaceous instead of Eocene, which might make the *Notostylops* mammal zone and the *Fagus* plant zone older Eocene than I formerly indicated. The elaboration of the mammals collected by the Scarritt Patagonian Expedition it is hoped will settle the position of the Patagonian history depicted in terms of the standard world section of the Tertiary.

There follow comments on certain of the plants collected by the Scarritt Patagonian Expedition:

The Fagaceæ

One species, which Dusén considered a *Fagus*, occurs under field number 417 (Amer. Mus. No. B–17) and at four other localities in the territories of Rio Negro, Magellanes and Tierra del Fuego. I am not convinced that *Fagus* can be distinguished from *Nothofagus* on the evidence of the leaves alone.

Two species from field number 417 are referred to *Nothofagus*. Dusén recorded 13 species and varieties of *Nothofagus* and two of *Fagus* from the Strait of Magellan and Tierra del Fuego, and the specific limits are such that the two which I have identified from southern Chubut Territory might perhaps be compared with some of the leaves which have been referred to *Nothofagus magellanica* Engelhardt, *Nothofagus variabilis* Dusén or *Nothofagus serrulata* Dusén, but this would in no wise alter the geologic or ecologic significance of their occurrence.

The genus *Nothofagus* was proposed by Blume for a group of antipodean species, some evergreen and others deciduous, which had formerly been referred to the Holarctic genus *Fagus*. Three or four are found in southeastern Australia and Tasmania, six in New Zealand and eight in Chile and the Andean border of southern Argentina. They are undoubtedly related to the northern *Fagus*, but the present disconnected distribution of the two has never been explained satisfactorily. One of the two Tasmanian and five of the Chilean species are deciduous.

Whether *Nothofagus* to-day represents the end products of a Cretaceous dispersal from the Northern Hemisphere or whether there has been some direct interchange of southern species by way of Antarctic lands, cannot be settled. Dusén believed that certain Eogene species from Patagonia were to be referred to *Fagus* instead of *Nothofagus*, but the known material, which is entirely foliar in nature, does not seem to me conclusive. There are also certain leaves in late Cretaceous and early Tertiary floras of the Northern Hemisphere which greatly resemble those of *Nothofagus* and whose true affinity I do not believe can be determined from the leaves alone, although Bandulska[1] has recently decided from cuticular studies that an Eocene species from Bournemouth, England, is a *Nothofagus* and not a *Fagus*. Fossil species of *Nothofagus*, from Australia, New Zealand, Tasmania, and Patagonia, have been described by Ettingshausen, Unger, Gilkinet, Englehardt, and Dusén, and all of these authors, especially the last, have been guilty of over-refinement in specific differentiation. From a slight experience with living forms in southern Chile, I am convinced that many of these quondam species might be included within the limits of variation of a single botanical species, especially when present within rather narrow geographic and stratigraphic limits as is the case with Dusén's species. Although I have retained both *Nothofagus simplicidens* and *Nothofagus densinervosa*, I doubt their specific distinctness

Petrified wood referred to *Nothofagoxylon* has been identified from Chile, Tierra del Fuego, Patagonia and Seymour Island.

Embothrites simpsoni Berry, n. sp.

Figure 3

TYPE.—Amer. Mus. No. B–4, impression and counterpart of seed.

Seeds compressed, bifacial, prominently winged, elongate-elliptical in outline, length about 19.5 millimeters, maximum width about 6.5 millimeters about half-way between apex and base. Hilum prominent, funiculate. The essential part of the seed is half-way between the base and apex of the wing on one side and is connected by a marginal strand of raphe-like vascular tissue. The seed is either anatropous or amphtropous, compressed, elongate-elliptical in outline. The wing is finely and transversely veined. Named for Dr. George Gaylord Simpson, the leader of the Scarritt Patagonian Expedition.

This winged seed appears to be referable to the family Proteaceæ, and the most obvious comparison is with the winged seeds of the South

[1]Bandulska, H. 1924. Jour Linn Soc Bot, XLVI, p 433

American genus *Embothrium*, since the seed is associated with *Embothrium*-like leaves referred to *Embothriophyllum dubium* Dusén. In the modern flora, *Embothrium* has four species in South America, ranging from the Straits of Magellan northward along the west coast of South

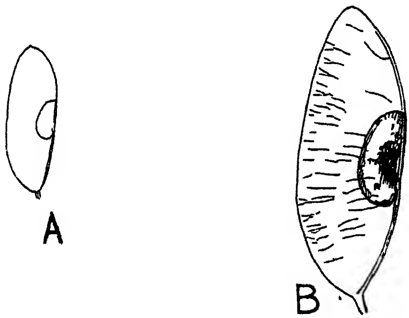


Fig. 3. *Embothrites simpsoni* Berry, new species.
Type, Amer Mus No B-4 *a* Natural size *b* Twice natural size

America to about Latitude 33° South, and a single species in Australia. Several fossil species based upon foliage have been described from the Oligocene and Miocene of southern Europe. Seeds of the general character of *Embothrium* have also been found fossil and are generally referred to the genus *Embothrites* proposed by Unger in 1850 for specimens from Sotzka, Styria. Eight to ten species have been described, all of which except the present species and one from the Oligocene of the southern United States are south European.

The present species differs from all the others known to me in having the seed moved upward in the wing a considerable distance from the hilum. In spite of the fact that many other plants have winged fruits and seeds of somewhat similar appearance, I think it a safe conclusion that the seed (*Embothrites*) and the associated leaves (*Embothriophyllum*) should be referred to the Proteaceæ and are probably related to the existing species of *Embothrium*, but it is possible that they may represent an extinct genus, since the disconnected distribution of the modern species indicates a long antecedent history.

The whole question of the geologic history of the Proteaceæ has been one that has inspired a considerable acrimonious controversial literature and was discussed at considerable length by me in 1916.[1] The modern and ancient distribution is too extensive a subject for dis-

[1]Berry, E. W. 1916. U. S. Geol. Survey Prof. Paper 91, pp. 83–87 (map).

cussion in this place. The presence of *Embothriophyllum*, *Embothrites* and a supposed *Knightia* in the Patagonian Eogene renders it pertinent, however, and I can only say that unless one is prepared to subscribe to the doctrine of the independent origin of the same genera on different continents, then one must admit that the ancestors of the existing species ranged over intervening areas and that the fossils which resemble them are related to them, which was disputed by Bentham and Hooker, or else fossils which do not resemble them are related to them, and this last, it seems to me, is absurd.

Rhoophyllum nordenskjöldi Dusén

Amer. Mus. No. B–9, the specimen and counterpart included in field number 455 which I have referred to this species, is absolutely identical with the type material which Dusén figures from Rio de las Minas near Punta Arenas, and has, moreover, a characteristic and easily recognized venation.

Although Dusén nowhere states the basis for his pseudogeneric name of *Rhoophyllum* to which he referred two species from Patagonia, I have always supposed it meant that they resembled the leaflets of various existing species of the subfamily Rhoideæ of the family Anacardiaceæ.

This is quite an extensive group, and at least six of the genera are South American. These are *Haplorhus*, *Thyrsodium*, *Mauria*, *Schinus*, *Lithræa*, and *Schinopsis*. The last three are members of the existing flora of the Argentine Republic, and *Rhoophyllum nordenskjöldi* from Punta Arenas and Cañadón Hondo, Chubut, might very well represent an extinct species belonging to any one of these three genera, the excuse for maintaining *Rhoophyllum* being the impossibility of deciding the generic relations more precisely.

AMERICAN MUSEUM NOVITATES

Number 537 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | June 9, 1932

56 9, 61 P (5C)

PLATYBELODON GRANGERI, THREE GROWTH STAGES, AND A NEW SERRIDENTINE FROM MONGOLIA[1]

BY HENRY FAIRFIELD OSBORN AND WALTER GRANGER

In addition to the type, paratype and eleven other specimens (A. M. 26200–A. M. 26212) of the 1928 collection as reported by the senior author,[2] the expedition of 1930 fortunately discovered two great quarries (Fig. 1) to the east of the Kalgan-Urga Trail which yielded an extraordinary assemblage of representatives of these species in all stages of growth from an unborn young, two juvenile stages to adults of both

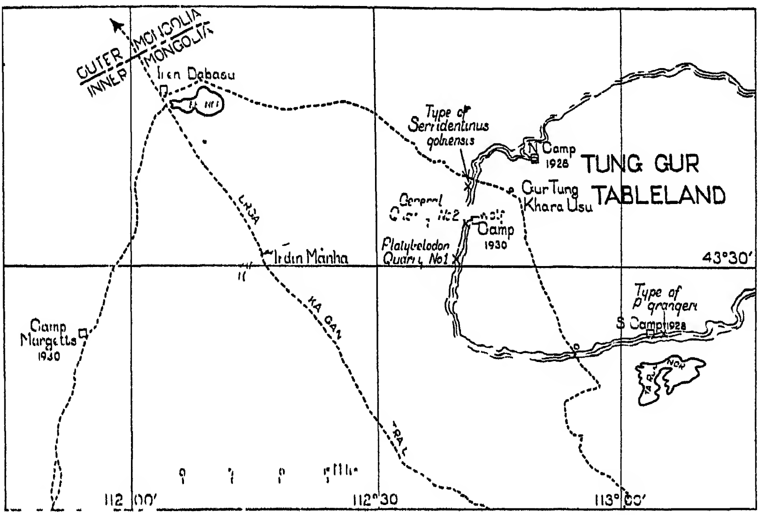


Fig. 1. Sketch map of the region around Iren Dabasu, Inner Mongolia.

The two working camps of the 1930 Central Asiatic Expedition are here shown in Wolf Camp in the Mio-Pliocene (*Platybelodon*) beds of the Tung Gur tableland and Camp Margetts to the westward in the Upper Eocene (Irdin Manha) and mid-Oligocene (Houldjin Gravels).

All specimens of *Platybelodon grangeri* have come from the Tung Gur tableland. The original discovery of this form in 1928 was at N. Camp, and the type and best preserved specimen came from S. Camp. In 1930 the specimens came mostly from two quarries along the western escarpment.

---

[1]Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 112.

[2]Osborn, H. F. 1931.847. The Shovel-Tuskers, Amebelodontinæ, of Central Asia. Amer. Mus. Novitates, No. 470, Apr. 10, pp. 1–12, text figs. 1–3.

sexes. Among these are the cranial and skeletal parts, mostly scattered, but fortunately one fine individual cranium and jaw (A. M. 26462) were found together, as represented in Figure 7. This unique collection enables us to amplify the original definitions and descriptions of the genus *Platybelodon* Borissiak and to extend our knowledge of the species *Platybelodon grangeri*, affording not only a complete definition of the species but greatly extended knowledge of the generic characters. Associated with these platybelodonts is a great variety of faunal associates which await generic and specific description, also a fine specimen (A. M. 26461) of a new *Serridentinus* which is here described as *Serridentinus gobiensis*, a welcome addition to the serridentine fauna of the ancient Gobi to which the species *Serridentinus florescens* was previously referred.

Platybelodon grangeri Life Zone, Tung Gur Formation of the Eastern Gobi Region

These beds, discovered in 1928 by Andrews and Spock, occur as a low peneplaned tableland more than 25 miles across. The northwestern edge of this deposit lies about 40 miles southeast from Iren Dabasu on the Kalgan-Urga Trail. Near the edge of this tableland at this point is an important well, known to all travelers in the region as Gur Tung Khara Usu. The horizon name Tung Gur was derived by reversing the first two words of this name.[1]

The Expedition used this Gur Tung Khara well for the first part of its 1928 work in the Tung Gur beds, and in 1930 camp was maintained in that vicinity throughout the Pliocene work. The beds are well exposed along the northern and western faces of the tableland and also for some distance along the southeastern face—bordering Tairum Nor, which latter place was worked in 1928 and which yielded the type jaws of *Platybelodon grangeri*. *Platybelodon* occurs throughout the exposures and is the diagnostic fossil of the Tung Gur beds. In 1928 the specimens of this genus were found more or less scattered, but in 1930 the majority of them came from two deposits or quarries which seem to have been bog-holes in which the animals became mired and killed. These two quarries were quite unlike in the fauna represented in them.

Quarry 1. (10 miles south of Gur Tung Khara Usu).

Yielded about 16 pairs of lower jaws of *Platybelodon*, 5 or 6 fairly complete skulls and a great quantity of skeleton material, a complete representation of which was saved. All but two or three of these platybelodonts were adults, and there was almost nothing else in the quarry except this form.

---

[1]Spock, L. Erskine. 1929. Pliocene Beds of the Iren Gobi. Amer. Mus. Novitates, No. 394, Dec. 26, pp. 1–8, text figs. 1–6.

Quarry ?. (5 miles south of Gur Tung Khara Usu).

Yielded portions of at least one adult *Platybelodon* and 7 or 8 very young individuals. One of these latter (A. M. 26465) is considered in a fœtal stage and was taken out from between the two *os innominata* of an adult.

In addition to *Platybelodon,* this Tung Gur quarry yielded a great quantity of smaller forms—rhinocerids, bovids of many sorts, carnivores, rodents and horses (*Anchitherium*)—which remain to be identified.

LIST OF PROBOSCIDEAN MATERIAL FROM THE TUNG GUR BEDS IN THE 1930 COLLECTION

Platybelodon grangeri

A. M. 26460. Lower jaws (see photographs). Quarry No. 1.

A. M. 26463. Upper incisor tooth. Quarry No. 1.

A. M. —— . A series of some 15 lower jaws and several skulls, together with much skeleton material. Quarry No. 1. Unprepared and unnumbered.

A. M. 26464. Skull and lower jaws, juvenile. Quarry No. 2.

A. M. 26465. Lower jaws and maxilla, tusk with enamel tip. Fœtal young. Quarry No. 2.

A. M. —— . Lower jaws and fragmentary skulls of 7 or 8 young individuals. Quarry No. 2. Unprepared and unnumbered.

A. M. 26462. Skull and lower jaws and portion of skeleton of female. Isolated specimen.

A. M. 26466. Maxilla and lower jaws. Isolated specimen.

A. M. 26467. Lower jaws. Isolated specimen.

Serridentinus gobiensis, sp. nov.

A. M. 26461. Right ramus of lower jaws with symphysis and both tusks. Isolated specimen.

Platybelodon grangeri Osborn, 1929

The genus *Platybelodon* was described by Borissiak in 1928 from the "Middle Miocene" of the Kuban region, to the northwest of the Gobi, the genotype species being *P. danovi.* In 1928 the Central Asiatic Expedition discovered the same genus in the eastern Gobi and as we were at the time unaware of Borissiak's discovery, it was named *Amebelodon grangeri* by the senior author, being considered congeneric with the long-jawed, flat-tusked form, *Amebelodon fricki,* discovered by E. H. Barbour in Nebraska. Upon the appearance of Borissiak's paper its real affinities were recognized.

While the material of *Platybelodon* in the 1928 collection was ample for generic reference and for specific determination, that of the 1930 collection is vastly greater, and will, when the preparation is finished, give complete knowledge of the skull, jaws and skeleton. Perhaps the

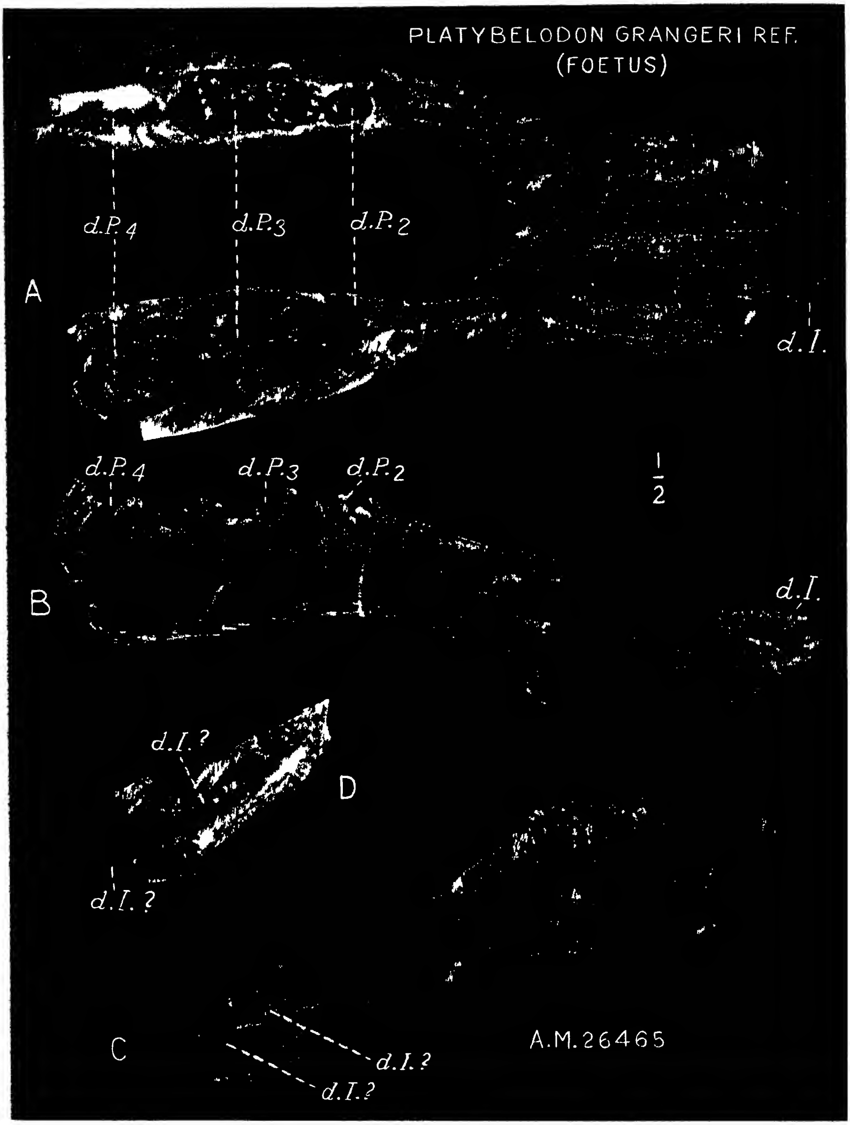


Fig. 2. Mandible and dentition of *Platybelodon grangeri* ref. (A. M. 26465). Quarry No. 2.

This very immature mandible is believed to be that of a foetus, as it was found within the pelvic bones of an adult. It contains the milk dentition, d.I to d.P_4 inclusive. A, crown view; B, outer view of right ramus; C, diagonal view of left ramus; D, view of left incisors with bone removed. One-half natural size.

most unusual feature of the 1930 collection is the series of specimens illustrating growth stages. These range from old adults down to very young or even fœtal specimens. A part of this material has already been prepared, and it is thought best to present at this time some of the more interesting of these specimens rather than wait for the final treatment of the entire collection.

Foetal Young.—(Figs. 2 and 3.) This specimen, consisting of a pair of lower jaws, a maxilla and a fragment of a premaxilla supporting the upper incisor, was found lying between the two halves of the pelvis of an adult *Platybelodon*, and this, coupled with the fact that none of the teeth is erupted, leads to the presumption that this was actually an unborn young. Some interesting characters are to be observed in this specimen which would be lost in an individual which had begun to use its teeth. Both upper and lower tusks are tipped with thin enamel which is indicated in the photographs

Fig. 3. Superior dentition of the same individual (A. M. 26465) as that represented in Fig. 2.

The teeth are identified as the superior milk incisor, A, inner, B, outer view; and premolars 2 and 3, C showing teeth in alveoli, D same teeth removed from alveoli. One-half natural size

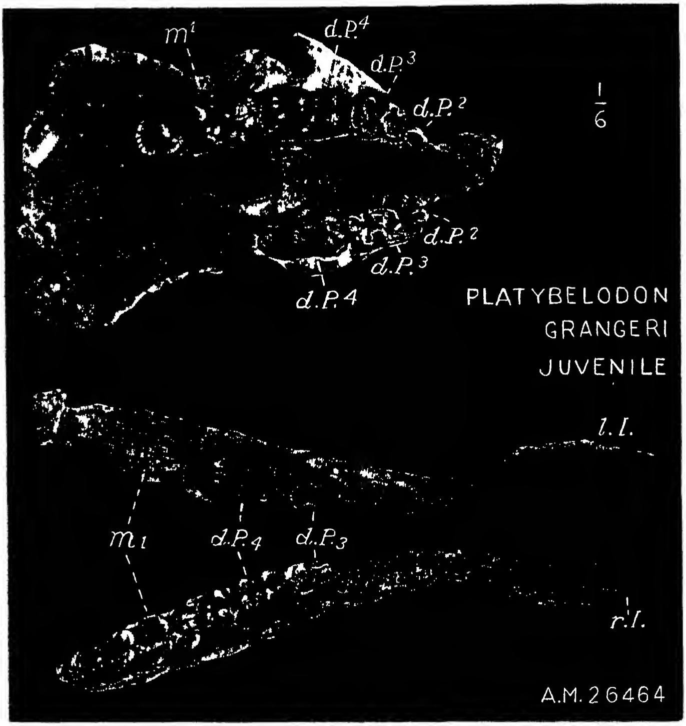


Fig. 4. Juvenile fragmentary cranium and nearly complete mandible of *Platybelodon grangeri* ref. (A. M. 26464). Quarry No. 2.

Containing the deciduous dentition and permanent M^1 and M_1 as indicated. The flattened incisors are indicated as R. I. and L. I and for the present interpreted as being the tips of the large permanent incisors represented in the adult stage in Figure 5. One-sixth natural size.

by darker coloring. The lower incisors present a scalloped anterior edge not perfectly shown in Figure 2. The presence of two incisors, one lying directly above the other and less advanced in growth, is a bit puzzling. It is presumed that the lower and more advanced one is a deciduous tooth. The upper one, which has a crown of about the same size as the other, may be a second deciduous incisor or possibly the germ of the permanent tooth. The anterior cheek tooth, above and below, is definitely the second deciduous premolar, as determined by working backward from an adult through a series of young individuals; in the lower jaw this is a simple peg-shaped tooth and was apparently lost early in the life of the individual.

JUVENILE.—(Fig. 4.) In this individual, which had probably attained the age of two years or more, the permanent lower incisor is already functioning and shows the characteristic bevel on the anterior edge. The first molar, above and below, is formed but not erupted. The second premolar is still retained in the upper jaw but has already been discarded in the lower jaw.

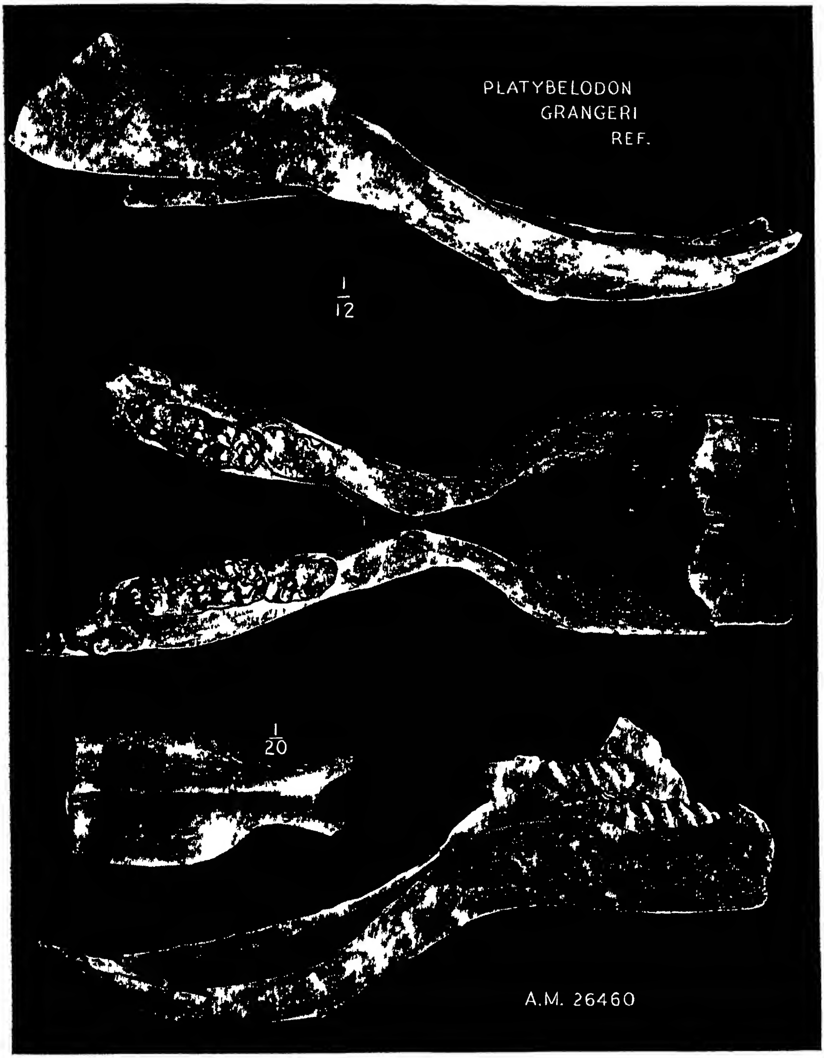


Fig. 5. Fully adult mandible and dentition of *Platybelodon grangeri* ref. (A. M. 26460). *Platybelodon* Quarry No. 1.

Superior and two lateral aspects, one-twelfth natural size. Inferior aspect of I_2 displaying the scissor-shaped lower surface, about one-twentieth natural size.

ADULT.—(Figs. 5 and 6.) The lower jaw of a fully adult animal with the M_3 in wear is uncrushed and exhibits in an admirable manner the profile of the ramus and the broad shovel-shaped symphyseal region. The bevel on the edges of the incisors is beautifully shown in this specimen. It seems probable that this bevel was produced by abrasion against a smooth rock or against the bottom of a shallow pond or stream in the process of scooping up vegetation, a process in which the broad short trunk was used in connection with the mandibular scoop.

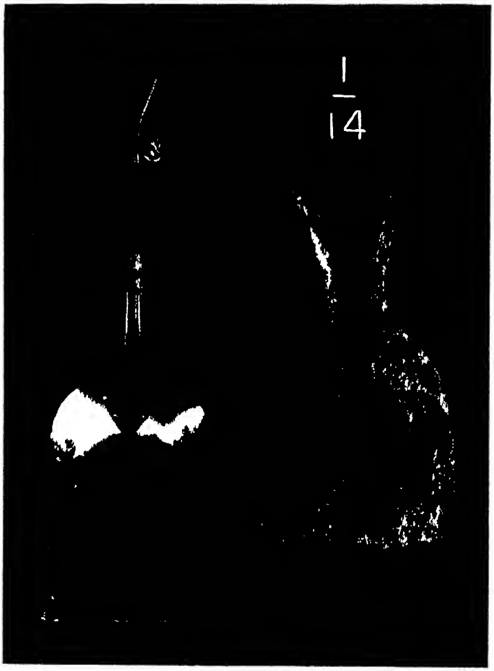


Fig. 6. *Platybelodon grangeri* ref. (A. M. 26460) anterior portion of the same mandible as in Fig. 5.

Inferior aspect of the lower pair of incisors, I_2, placed beside a coal shovel with the same transverse diameter of the anterior cutting portion of the inferior incisors, namely, fourteen inches. One-fourteenth natural size.

Platybelodon

INFERIOR CHEEK TEETH MEASUREMENTS[1]

	Foetus A.M. 26465	Juvenile A.M. 26464	Young A.M. 26201	Adult A.M. 26203
d. P_2 ap.	10 mm.			
tr.	6.5			
h.	9.5			
d. P_3 ap.	48	46 mm.		
tr.	32	32		
h.	26	?		
d. P_4 ap.		80		
tr.		39		
h.		35		
M_1 ap.		101	81+ mm.	
tr.		41	52	
h.		?	(Much worn)	
M_2 ap.			124	118 mm.
tr.			62	63
h.			50+	(worn)
M_3 ap.			not	211
tr.			fully	76
h.			formed	. 78 approx.

[1]A. M. 26201 and A. M. 26203 are from the 1928 collection.

Platybelodon

SUPERIOR CHEEK TEETH MEASUREMENTS

	Foetus A.M. 26465	Juvenile A M. 26464	Young A M. 26201	Old Adult A.M. 26462
d. P^2 ap.	25 mm.	23 mm.		
tr.	16	17		
h.	14	12+		
d. P^3 ap.	47	46		
tr.	30	34 5		
h.	24	20+		
d.P^4 ap.		75		
tr.		41		
h.		33		
M^1 ap.		101	115 mm.	
tr.		52 est.		
h.		50 est.		
M^2 ap.			imperfect	112+ mm.
tr.				70
h.				
M^3 ap.				184
tr.				?
h.				

Platybelodon

INFERIOR INCISOR MEASUREMENTS

	Foetus A.M. 26465	Juvenile A.M. 26464	Young A.M. 26201	Old Adult A.M. 26462
d. I_2 ap.	82 approx.		Incisors not preserved	
tr. (at cutting edge)	25 5			
I_2 ap.		140 est.		400 est.
tr. (at cutting edge)		56		175

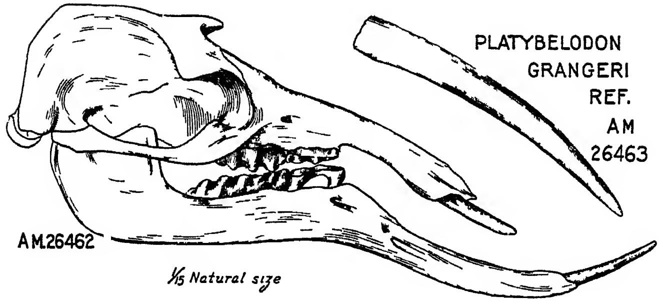


Fig. 7. *Platybelodon grangeri* ref. (A. M. 26462), an isolated specimen from the Tung Gur horizon, found with the cranium and jaws and parts of skeleton associated; a female. One-fifteenth natural size.

Male superior tusk of *Platybelodon grangeri* ref. (A. M. 26463) from *Platybelodon* Quarry No. 1. One-fifteenth natural size. Drawn to the same scale to show the marked disparity between the male and female tusks.

Serridentinus gobiensis, sp. nov.

TYPE.—A. M. 26461. A finely preserved right ramus of the lower jaw supporting M_{2-3} and with complete symphysis and both incisors.

HORIZON AND LOCALITY.—From the Tung Gur Lower Pliocene beds about 40 miles southeast of Iren Dabasu, Inner Mongolia. Found by R. C. Andrews, Central Asiatic Expedition, 1930.

SPECIFIC CHARACTERS.—Extreme length of ramus from tip of incisor tooth to posterior border = 109 cm. Extension of lower incisor beyond alveolar border = 12.5 cm. Greatest diameter of tusk at alveolar border = 5 cm. M_2 a-p = 12.5 cm.; tr. = 8.5 cm. M_3 a-p. = 19.5 cm ; tr. = 8 7 cm. The lower border of the ramus, from the alveolar edge to the angle of the jaw, is a nearly straight line which is set off at an angle of about 15° from the plane of the molar crowns. Lower tusks rounded on the lower and outer surface and somewhat flattened on the lingual face. M_2 with three ridges, M_3 with four ridges and a heel. Serrated spur-crests or molar borders. Molar pattern extremely simple and lophodont.

Serridentinus gobiensis may be compared with three other species of the genus from Central Asia. From *Trilophodon* (*Serridentinus*) *inopinatus* Borissiak[1] it differs in its much greater size—the M_3 being about one-third longer—and in the presence of an extra half-loph on M_3. The rather highly elevated condyle and coronoid in the present species is a further distinction from Borissiak's form. From *S. mongoliensis* Osborn[2] from the Loh formation, and *S. florescens* Osborn[3] from the Kunuk

[1]Borissiak, A, and E Belïaeva 1928 *Trilophodon* (*Serridentinus*?) *inopinatus*, n sp, from the Jilančik Beds of the Turgai Region Bull Acad Sci, USSR, Cl Sci phys-math, pp. 241–252, Pls. I, II

[2]Osborn, H F 1924 630 *Serridentinus* and *Baluchitherium*, Loh Formation, Mongolia Amer. Mus Novitates, No 148, Nov. 11, pp 1–5, text figs 1, 2, p 1

[3]Osborn, H F, 1929 797 New Eurasiatic and American Proboscideans Amer Mus Novitates, No. 393, Dec 24, pp 1–23, text figs 1–22, p 6

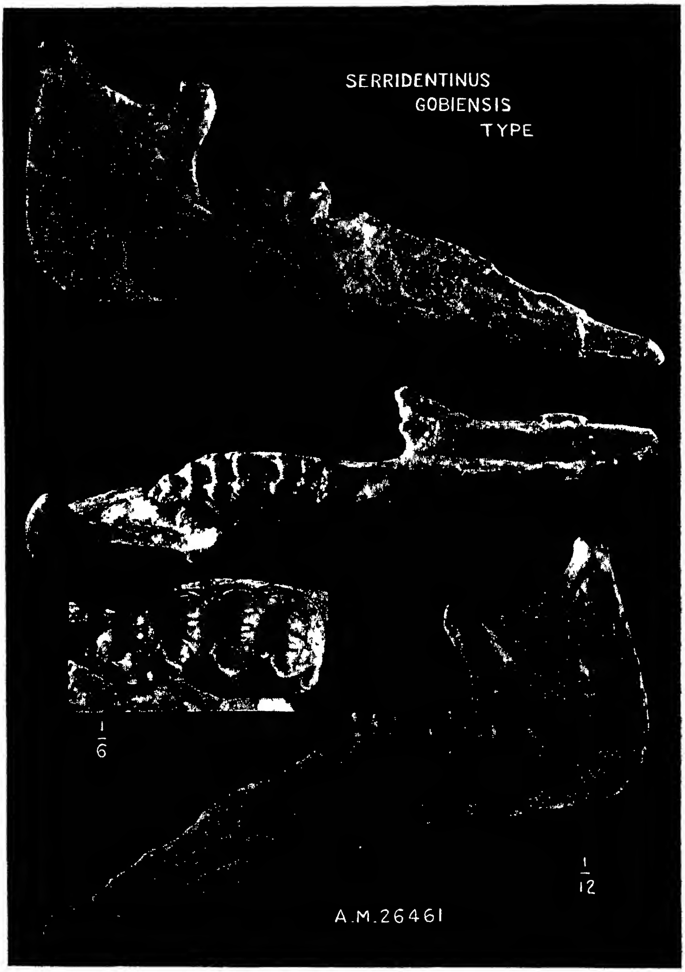


Fig. 8. Type of *Serridentinus gobiensis*, sp. nov. (A. M. 26461). From the Tung Gur formation.

An isolated adult specimen exhibiting the rod-like inferior incisors, the three-crested second inferior molar and a 4⅓rd-crested third inferior molar. Three aspects of the mandible after retouched photograph, one-twelfth natural size. Inset—retouched photograph of 4⅓rd-crested R.M_3 exhibiting the crescentic external spurs characteristic of the genus *Serridentinus*. One-sixth natural size.

beds, both of the western Gobi, this species is readily distinguishable by the simplicity of the molar pattern. *S. gobiensis* may be of approximately the same age as *S. mongoliensis*, but it is without much doubt older than *S. florescens*, which is not older than late Pliocene.

The fact that, aside from a few tooth fragments, this type jaw is the only mastodont, other than *Platybelodon*, found in the Tung Gur region would indicate that either it was a relatively very rare form or that its habitat was different. The latter theory seems the more probable. With few exceptions, *Platybelodon* has been found in direct association with quantities of fresh-water bivalves, suggesting that this region was at that time the shore-line of a lake of considerable extent. *Platybelodon*, with its broad flattened lower tusks, evidently found the region to its liking and very likely used its shovel-shaped jaw to scoop up succulent water plants. *Serridentinus*, on the other hand, with its small rounded tusks probably had quite different food habits and consequently a different range; it was an 'uproot tusker.'

AMERICAN MUSEUM NOVITATES

Number 538 | Published by The American Museum of Natural History New York City | June 15, 1932

59.82 (85)

STUDIES OF PERUVIAN BIRDS. V

THE GENERA *HERPSILOCHMUS*, *MICRORHOPIAS*, *FORMICIVORA*, *HYPOCNEMIS*, *HYPOCNEMOIDES*, AND *MYRMOCHANES*

By John T. Zimmer

In continuance of the systematic review of Peruvian birds, of which four numbers have already appeared,[1] there is presented herewith the report on six genera of Formicariidæ. In the study of *Hypocnemis*, so much extralimital material was examined that it has been adjudged desirable to include notes on all the members of the genus.

I am indebted to the authorities of the Field Museum of Natural History, Chicago, and the United States National Museum, Washington, for the generous loan of certain comparative material used in this study.

Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

Herpsilochmus axillaris (Tschudi)

Th(amnophilus) axillaris Tschudi, 1844, Arch. Naturg., X, (1), p. 278—Perú (north to about 10° S. lat., east of the Andes); ♀; Mus. Neuchâtel.

The material at hand is not at all satisfactory for the determination of the variations within this species. A female from Tulumayo, Junín, is probably nearly topotypical (since Tschudi did not travel north in central Perú farther than the Cerro de Pasco region, somewhat short of 10° S. latitude), and agrees well enough with Tschudi's description, including the white face. A male from the Río Tavara seems to go well with the female. In both examples the white on the rectrices is relatively narrow on the third and fourth pairs (counting from the exterior), exposing more or less of the dusky subterminal portions; the female also has some dusky marking exposed on the bases of the outermost feathers. The under parts are relatively dull, pale yellow.

A female from Huarandosa, Río Chinchipe, Perú, and a male from the lower Sumaco, eastern Ecuador, are somewhat different. Both are rather deeper yellow below, the female strikingly so. The auriculars

[1]American Museum Novitates, 500, 509, 523, and 524.

are more yellow than white; the white tips of the rectrices completely conceal all traces of dusky subterminal areas in the closed tail (though this may be due to their being less worn than those of the birds from farther south). The upper surface of the female is a little brighter olive than that of the Huarandosa female, and the crown is duller brown posteriorly, with the feathers distinctly tipped with dusky. The male has little trace of blackish centers on the feathers of the mantle (so noticeable in the Río Tavara male), and the white spots of the crown are, if anything, broader and more conspicuous than in the Río Tavara skin; the lores are more extensively pale in both sexes from the north.

However, a female I collected at Huachipa has the auriculars yellowish and the under side of the body bright yellow, agreeing best with the Huarandosa skin. Dr. Hellmayr records a female from Huaynapata, Marcapata, which he found to agree closely with Tschudi's type. Tschudi's description of "Gesicht . . . weisslich" would seem to indicate more white on the face, but Taczanowski says "joues jaunâtre" for both Tschudi's type and his own *puncticeps* from Huambo, which he says are identical except for certain differences that he notes. The supposed characters of Taczanowski and Berlepsch's *H. a. aequatorialis* are not borne out by the Ecuadorian male at hand; the female was said to be no different from Peruvian females. If separable, the Huarandosa female should belong to it. Consequently, though we have evidence of noticeable differences in various specimens from diverse localities, and two additional names are available by which to designate any separable forms, it will require more material than now exists in all recorded collections to determine the advisability of recognizing more than the single form.

The female from Tulumayo has an added character in the distinctly brownish tone of the exterior margins of some of the remiges, probably due to immaturity.

SPECIMENS EXAMINED

H. axillaris.—PERÚ: Tulumayo, Junín, 1 ♀; Río Tavara, 1 ♂; Huarandosa, Río Chinchipe, 1 ♀; Huachipa, 1 ♀.[1] ECUADOR: lower Sumaco, 1 ♂.

Herpsilochmus pileatus motacilloides Taczanowski

Herpsilochmus motacilloides TACZANOWSKI, 1874, Proc. Zool. Soc. London, p. 136—Maraynioc; ♂ immature; type formerly in Warsaw Museum, now lost.

The present subspecies is much more distinct from *p. pileatus* and *p. atricapillus* than these two are from each other, judging by some puzzling

[1]Specimen in Field Museum of Natural History, Chicago

material at hand from eastern Brazil. The black or blackish spot on the lores in both sexes of the Peruvian birds, the yellowish tone of the under side and the olivaceous tone of the upper side in the males, and the brownish backs, pale buffy yellow under parts, and deep ochraceous brown foreheads in the females are quite positive characters. The amount of white on the tips of the rectrices is also at the maximum in both sexes, but is not always diagnostic.

Contrary to the statement of Dr. Hellmayr (Field Mus. Nat. Hist. Pub., Zool. Ser., XIII, pt. 3, p. 173, footnote *a*, 1924), males of this form may have a noticeable amount of white on the interscapular region. Both of the males at hand have quite extensive traces of subterminal white and very heavy black tips.

Previous records are from Maraynioc, Idma, Garita del Sol, and La Gloria.

SPECIMENS EXAMINED

H. p. motacilloides.—PERÚ: Idma, above Santa Ana, 1 ♂, 2 ♀; Utcuyacu, Junín, 1 ♂, 1 ♀.

Herpsilochmus rufimarginatus subspecies

I regret that there is no material of this species from Perú available for study. According to Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 178, footnote *a*, 1924), the birds from Perú and Matto Grosso, Brazil, are intermediate between *r. rufimarginatus* and *r. frater*, having the males like the former and the females like the latter. They thus present the same curious situation to which I called attention in my description of *Myrmotherula axillaris heterozyga* (Amer. Mus. Novit., No. 524, p. 7, 1932). If persistent over the range of territory indicated, these characters should entitle the possessor to a name which I am unwilling to give in the absence of material. Peruvian records are from Monterico and Yahuarmayo.

Microrhopias quixensis albicauda Carriker

Microrhopias quixensis albicauda CARRIKER, 1932, Proc. Acad. Nat. Sci. Phila., LXXXIII, p. 465—La Pampa, Sándia, Dept. Puno, Perú; ♂ ad.; Acad. Nat. Sci. Phila.

Two males and a female from the Río Tavara are nearly topotypical and are recognizably distinct from *bicolor* from the Rio Madeira though not entirely as described for *albicauda*. Some of a long series of *bicolor* approach these very closely in the amount of white on the rectrices, and

several females are darker rufous below than the Río Tavara skin of the same sex. Carriker gives the average length of the white tips on the rectrices but does not give the range of variation, nor does he state whether this measurement was taken along the shaft or along the greatest extension on either web away from the shaft. No other measurements are given except the statement that the bill averages one millimeter longer than in *bicolor*.

The small series at hand shows the males with wing, 27.25–58 mm.; tail, 53.75–54.75; exposed culmen, 11.5–13.25; culmen from base, 15.75–16; tarsus, 17.75–18. Female: wing, 58.25; tail, 55; exposed culmen, 13; culmen from base, 16.75; tarsus, 17.25.

To these measurements may be added those recorded by Hellmayr (Arch. Naturg., LXXXV, A, (10), p. 102, 1920) regarding birds from Yahuarmayo and Cosñipata. Nine males: wing, 57–62 mm., tail, 52.5–60; culmen (exposed ?), 14.5–15. Four females: wing, 55.5–59; tail, 50–57; culmen, 13.75–14.5.

Males of *bicolor* have the following range of measurements: wing, 51–56 mm.; tail, 44.25–52 (–54, ex Hellmayr); exposed culmen, 12–13.5; culmen from base, 15.25–16.5. Females: wing, 49–54; tail, 45–50.5 (–51, ex Hellmayr); exposed culmen, 11.5–13.5; culmen from base, 15.25–16.75.

Compared with *bicolor*, therefore, the wings and tail of *albicauda* are distinctly longer, but there is no difference in the length of the bill. The white tips on the outermost rectrices in the Río Tavara *albicauda*, measured along the shaft, are 23.75–27 mm.; on the web, 25–27. In *bicolor* the figures along the shaft are 14.5–19.5. On the fourth rectrices, from the outside, along the shaft, the Río Tavara skins of *albicauda* show 20–23 mm.; on the webs, 23–30. In *bicolor* the range is, along the shaft, 3.5–18; along the webs, 9–26.5. Thus *albicauda* has a greater average extension of white on the tail, as pointed out by the describer. An easily recognizable difference seems to be on the next to the middle pair of rectrices which in *albicauda* have a large terminal spot, but in *bicolor* are either without white or with a small white tip, decidedly smaller than in *albicauda*. The upper surface of the females is largely black, with the head and neck as dark as the mantle, not gray as in *bicolor*.

Carriker's assignment of the Río Comberciato male (recorded by Chapman in 1921) to his *albicauda* is hardly justifiable on geographic grounds. I have discussed this specimen further under *nigriventris*.

Microrhopias quixensis intercedens, new subspecies

TYPE from Sarayacu, Río Ucayali, Perú. No. 238,202, American Museum of Natural History. Adult female collected July 17, 1927, by Carlos Olalla and sons.

DIAGNOSIS.—Similar to *M. q. bicolor* of the Rio Madeira but slightly larger; females much blacker above. Like *M. q. albicauda* of southeastern Perú in size and dark dorsal coloration of the females, but white tips of the rectrices shorter, as in *bicolor;* females with under wing-coverts and axillars tinged with pink as in *bicolor*.

RANGE.—Lower Ucayali and adjacent parts of the south bank of the Amazon east of the Ucayali.

DESCRIPTION OF TYPE.—Upper surface black; feathers of top of head with blackish-gray margins distinguishable from the rest of the feathers only in certain lights; feathers of mantle with white basal portions making a large concealed patch; forehead and lores slightly grayish black; subocular region, auriculars, and sides of neck black. Entire under part of head and body deep Sanford's Brown; thighs black with whitish or pale rufescent tips. Tail graduated for 14 mm.; middle two pairs of rectrices uniform blackish; fourth pair (from without) with white tips measuring 12 mm. (right) and 13 mm. (left) on the shaft (17 mm. on longest extent on the outer webs); third pair, 17 on shaft (23 on outer web); second pair, 20 on shaft (24 on outer web); outermost pair, 17 on shaft (23 on outer web). Remiges Fuscous-Black, exterior surface deep black; greater and median wing-coverts and alula largely black with a rounded terminal spot of white, much the largest on the greater series, obsolete on the inner primary-coverts; the lesser coverts along the radial border pure white, those immediately adjacent with white bases and black subterminal portions tipped with a small rounded white spot (as in the median series), making a broad, white shoulder patch; under wing-coverts and inner margins of remiges (except at tip) white; axillars white with a pinkish tinge. Bill and feet black. Wing, 55 mm.; tail, 47.75; exposed culmen, 13.5; culmen from base, 17; tarsus, 17.25.

REMARKS.—Males uniform black above and below except for white interscapular patch, white tips on rectrices, white spots on upper wing-coverts and axillars, white area on shoulder, and white wing-lining which are as in the female except that the axillars are not pinkish but pure white (white on inner primary-coverts not obsolete in the two males and one of the females).

The white on the outer rectrices varies between 15.5–26 mm. along the shaft and 17.5–27 along the web (there is only one feather showing 26 and 27 mm.; its mate on the opposite side of the tail has only 22 and 23); on the fourth pair it varies between 5–20 along the shaft and 17–23 along the web. The type is the only example with no white on the fifth pair of rectrices; the others have a fairly large spot at the tip occupying both webs. The feature is somewhat variable also in *bicolor*, though not to the extent shown here. None of the *bicolor* examined have as much white as some of the specimens of *intercedens*.

I am not sure that I would separate *intercedens* from *albicauda* if it were not for the separation of their respective ranges, though to unite

them would necessitate reducing the average measurements given for the extent of white on the tail of *albicauda.* More important is the question of distribution. The female of *intercedens* from Orosa shows indications of transition toward the gray anterior upper parts of *bicolor* (though Hellmayr records a blackish-backed female from Teffé), and connection by that route is not very probable. The region of Sándia and the Río Tavara is in the drainage of the Madre de Dios and its tributaries; the Beni, into which the Madre de Dios empties, is occupied by *bicolor* which closes that avenue of connection. Sándia is in the upper level of the Tropical Zone; Sarayacu is in the lower level, and the Ucayali on its upper reaches is occupied by *nigriventris* which blocks a third possible, though unlikely, means of connection.

It seems evident, therefore, that the similarity between *albicauda* and *intercedens* is caused rather by parallelism than by strict genetic relationship, in which case smaller differences may serve as criteria for separation than in the case of contiguous ranges.

Microrhopias quixensis nigriventris Carriker

Microrhopias quixensis nigriventris Carriker, 1930, Proc. Acad. Nat. Sci. Phila., LXXXII, p. 368—Puerto Yessup, Dept. Junín, Perú; ♀ ad.; Acad. Nat. Sci. Phila.

I have not seen females of this interesting subspecies, which appears to be confined to the upper Río Ucayali and Río Urubamba. Lower down the Ucayali, its place is taken by *intercedens.*

The male from the Río Comberciato, Urubamba Valley, recorded by Chapman as *Microrhopias bicolor* subspecies, should be referred to *nigriventris* and not to *albicauda* as was recently proposed by Carriker. The specimen, kindly loaned to me by Dr. Friedmann of the U. S. National Museum, has distinctly less white on most of the rectrices than *albicauda,* though it agrees with *albicauda* in size. The Río Comberciato is in direct zonal connection with the upper Ucayali but is quite cut off from the upper Tambopata and Madre de Dios drainages, the home of *albicauda.* The logical association of the Río Comberciato skin is, therefore, with *nigriventris,* at least until further evidence is made available by the collection of a female in that region.

Microrhopias quixensis quixensis (Cornalia)

Thamnophilus quixensis Cornalia, 1849, 'Vertebr. Syn. Mus. Mediol. extant. Osculati coll.,' p. 12—e. Ecuador; ♂ ad.

Thamnophilus rufiventer Cornalia, *loc. cit.,* —e. Ecuador; ♀.

A male and female from Puerto Indiana belong to this east-Ecuadorian form which has been recorded already from Nauta, also on the north bank of the Amazon in northeastern Perú.

SPECIMENS EXAMINED

M. q. quixensis.—ECUADOR: Río Suno above Avila, 1 ♂, 3 ♀; lower Río Suno, 1 ♂, 3 ♀; mouth of Río Curaray, 6 ♂, 2 ♀; mouth of Lagarto Cocha, 1 ♂; below San José, 3 ♂, 4 ♀; "Ecuador," 1 ♀. PERÚ: Puerto Indiana, 1 ♂, 1 ♀.

M. q. albicauda.—PERÚ: Río Tavara, 2 ♂, 1 ♀.

M. q. intercedens.—PERÚ: Sarayacu, lower Ucayali, 1 ♂, 3 ♀; Orosa, Río Amazonas, 1 ♂, 1 ♀.

M. q. nigriventris.—PERÚ: Río Comberciato, 1 ♂.[1]

M. q. bicolor.—BRAZIL: Rio Tapajoz (left bank), Igarapé Brabo, 5 ♂, 5 ♀; Boim, 1 ♂; Igarapé Amorín, 2 ♂, 1 ♀; Limoãl, 1 ♀; Villa Braga, 1 ♀; Rio Madeira, Borba, 10 ♂, 5 ♀; Porto Velho, 2 ♂; Igarapé Auará, 7 ♂, 1 ♀; Rosarinho, 2 ♂, 2 ♀; Rio Roosevelt, "Camp 16," 1 ♂; Arumanduba, 1 ♂; Villa Bella Imperatríz, Rio Amazonas, 5 ♂, 5 ♀. BOLIVIA: lower Río Beni, 1 ♀.

M. q. emiliae.—BRAZIL: Rio Tapajoz (right bank), Aramanay, 2 ♂, 2 ♀; Tauarý, 3 ♂, 2 ♀; Rio Xingú (right bank), Tapará, 1 ♂, 2 ♀.

Formicivora rufa urubambae, new subspecies

TYPE from Santa Ana, Urubamba Valley, Perú; elevation 3500 ft. No. 145,133, Americon Museum of Natural History. Adult female in worn plumage collected July 16, 1916, by Chapman and Cherrie.

DIAGNOSIS.—Somewhat intermediate in coloration between *F. r. rufa* (=*rufatra* auctorum) of southern Brazil, and *F. r. chapmani* (=*rufa* auctorum) of Santarem, but larger than either. Upper side and tail more as in *rufa*. Under parts more as in *chapmani*, but black streaks of the females a trifle narrower (much broader than in *rufa*).

RANGE.—Urubamba Valley, Perú.

DESCRIPTION OF TYPE.—Back Tawny x Ochraceous-Tawny; top of head duller, Tawny x Tawny-Olive, with shafts inconspicuously darker, browner; rump and upper tail-coverts Cinnamon. Lores blackish on lower portion; upper part whitish, continued over the eye in a broad white superciliary line, reaching the hind neck and varied over the auriculars by blackish shaft stripes; eyelids white except for dusky anteocular and postocular spots; rest of sides of head, chin, throat, breast, and upper half of abdomen with broad blackish shaft stripes margined with white; sides similar, but tipped with the color of the back; flanks Cinnamon-Buff; lower abdomen paler; under tail-coverts somewhat darker and browner with white tips. Thighs dusky at base and tipped with white on inside of leg, with Cinnamon-Buff on exterior of leg. Middle rectrices tinged with Verona Brown on basal half, blacker distally and narrowly tipped with white; lateral margins basally the color of the back; remaining rectrices a little more blackish, laterally margined like the middle pair and progressively more widely tipped with white, widest on three outer pairs; outermost pair with a narrow external margin of white. Remiges dark brown, exteriorly margined with

[1]Specimen in U. S. National Museum, Washington.

lighter brown, a little darker than the back. Greater upper wing-coverts more sooty brown, with pale brown outer margins and broad white tips; lesser and most of median coverts blacker subterminally, without brown margins, and with triangular white tips; primary-coverts similar with a touch of buff on white tips on inner webs; alula blackish with broader white tips; innermost lesser coverts white; scapulars like back with faint traces of subterminal black and terminal white markings on the outer webs of some of them, near the tips. Under wing-coverts and axillars white; inner margins of quills pinkish white. Bill and feet blackish (in dried skin). Wing, 55 mm.; tail, 58; exposed culmen, 14.5; culmen from base, 17; tarsus, 22.

REMARKS.—A second female not fully adult but in molt has the upper side in fresher plumage and decidedly darker, nearest Russet x Cinnamon-Brown, with dusky shaft markings more pronounced. Lower under parts a little deeper, Clay Color.

Males similarly variable above; a worn specimen is pale and a freshly molted one dark, matching the two females. Superciliary line and eyelids white as in females. Rest of sides of head, chin, throat, breast and middle of abdomen pure black; bordered all around by a broad white line meeting the posterior end of the superciliary stripe. This white stripe is edged exteriorly with Cinnamon-Buff, including the tips of the feathers on many of the white areas of sides and flanks. Under tail-coverts, tail, wings, and wing-coverts as in the female. Wing, 56, 56.5 mm.; tail, 58; exposed culmen, 14, 15; culmen from base, 18, 18.25; tarsus, 23, 24.75.

Sclater and Salvin's record of *rufatra* from Maranura belongs with the new form.

The study of the comparative material listed below has brought to light an unfortunate situation which calls for correction. Wied, in 1831, described two females, which he obtained in the inner regions of Bahia, as *Myiothera rufa*. In 1837, D'Orbigny and Lafresnaye named the bird found in Chiquitos, eastern Bolivia, *Thamnophilus rufater*. In 1916, Cherrie described a new form from near Santarem, Brazil, as *Formicivora rufa chapmani*, comparing it to Matto Grosso skins. Hellmayr, in 1924, recognized the existence of two distinct forms in Brazil (and Bolivia) and, finding certain Bahia skins distinct from southwest-Brazilian and Bolivian examples and agreeing with a Santarem example, placed *chapmani* as a synonym of *rufa* and recognized "*rufater*" as a separate conspecies. The two types of Wied's *rufa* are before me and serve as the basis for the present discussion, since they are decidedly of the lightly streaked form which ranges across southern Brazil and Bolivia, and very distinct from a series of Santarem specimens. It seems to be unavoidable, therefore, to submerge *rufatra* under *rufa* and to recognize *chapmani* as distinct.

If these types are truly from Bahia they must be from some extreme southern locality. I have no females from the eastern coast to help solve the difficulty, and a number of males from that region are not at all helpful. Two males from southern Piauhy, one male from Espirito Santo, and one from São Paulo all approach the Matto Grosso males more closely than they resemble the Santarem specimens, though Hellmayr, in 1929, describes females from southern Piauhy as being more heavily streaked than Matto Grosso skins and thus like Santarem specimens. Probably this region is one of intergradation where various stages of intermediacy may be found. In view of Hellmayr's study of Piauhy females, I refer the two males at hand from that region to *chapmani*, though they are unidentifiable as such by themselves.

In accordance with the 'International Rules of Zoological Nomenclature,' it is necessary to use the name *Formicivora* for this genus since it is not preoccupied by *Formicivorus* Temminck, 1807 (=*Myrmornis* Hermann, 1783).

SPECIMENS EXAMINED

F. r. chapmani.—BRAZIL: Altar do Chao, Santarem, 1 ♂ (type); Santarem, 7 ♂, 6 ♀, 1 ("); "Gilbues" (=Gilboez), Piauhy, 2 ♂.

F r. rufa.—BRAZIL: (Bahia), 2 ♀ (types); Lagôa Juparaná, Espirito Santo, 1 ♂; Franca, São Paulo, 1 ♂; Campanario, southern Matto Grosso, 1 ♂; São Francisco Ranch, 1 ♂; Chapada, 4 ♂, 1 ♀; Urucum, 3 ♂, 4 ♀; Descalvados, 1 ♂; Tapirapoan, 1 ♂; Campos Novos, 1 ♂, Palmira, Rio Taquary, 1 ♀.

F. r urubambae.—PERÚ: Santa Ana, Urubamba Valley, 1 ♂, 1 ♀ (type); Chauillay, 1 ♂, 1 ♀.

Hypocnemis cantator peruviana Taczanowski

Hypocnemis cantator, peruvianus TACZANOWSKI, 1884, 'Orn. Pérou,' II, p. 61—Yurimaguas, n. Perú; Warsaw Mus.

A good series of specimens from different parts of northern Perú south of the Amazon and Marañón rivers shows considerable variation in both sexes but no differences that are associated with distribution. Consequently, I am unable to recognize any separable subspecies in this part of the range, including also western Brazil in the neighborhood of Teffé.

The same can not be said of examples from other parts of Brazil south of the Amazon and east of Teffé which heretofore have been referred to *peruviana*. Ninety skins from the Madeira, Tapajoz, Xingú, and Tocantins rivers and from Matto Grosso show several well-marked lines of divergence in coloration, each of which occupies a different geo-

graphical area, though specimens from the peripheries of these areas show strong tendencies toward the adjacent forms. For one of these forms, an early name has been found which I believe is applicable to the form in question; the others are described below as new. Brief notes are added on the other members of the species, of all of which a critical examination has been made in the course of this study.

I have included in the species the various members of the "*flavescens*" group which I am convinced are conspecies of *cantator*, *peruviana*, and *notaea*. A more detailed discussion of this proposal will be given in the account of *collinsi*.

The present subspecies, *peruviana*, appears to be confined in Perú to the valleys of the lower Huallaga, Ucayali as far south as the mouth of the Urubamba, their affluents, and the adjacent portions of the south banks of the Marañón and Amazon, and eastward across the Javari and the Juruá at least to Teffé, Brazil. Records in Perú, other than the specimens listed hereunder, are from Yurimaguas, Xeberos, Chyavetas, Chamicuros, Santa Cruz (Huallaga), Samiría, and the Río Javari.

Hypocnemis cantator saturata Carriker

Hypocnemis cantator saturata Carriker, 1930, Proc. Acad. Nat. Sci. Phila., LXXXII, p. 368, Voca, Río Curaray (=mouth of Río Curaray), Ecuador; ♂ ad.; Acad. Nat. Sci. Phila.

This form was described from insufficient material, and most of the characters ascribed to it are useless, being found in equal prominence in typical *peruviana*. In a series of fifty-three skins from Colombia, Ecuador, and Perú north of the Amazon, there is only one male which has more black on the breast than some typical *peruviana;* there is only one which has the belly pure white (as is sometimes the case in *peruviana* also), while most of the birds from both north and south of the Amazon have the belly distinctly yellowish; in neither group is the pale area of the belly more restricted than in the other. The buffy tips of the secondaries are present in some Ecuadorian skins though possibly more often strongly developed in *peruviana*. The single character mentioned by the describer that is of particular service in distinguishing an Ecuadorian form is the average depth of the rufous color of the flanks and crissum. This color is slightly deeper in some birds from north of the Amazon than in those from south of it, but there is much overlapping. The same may be said of the color of the tail. Similarly among the females, this character is observable, though it is not constant. There is no difference in the color of the secondaries and tertials in the two series, nor in the

amount of black streaking on the mantle, though more of the Ecuadorian birds show a minimum of marginal white on the interscapular feathers.

Several females from Zamora, Ecuador, are more heavily marked with black on the breast than the average, but some of the series of *peruviana* are hardly less heavily marked. The ground color of the breast in most of the Ecuadorian females is, however, more strongly buffy than in the average of typical *peruviana*.

Probably, in view of the apparent separation of the rangês, it may be as well to recognize *saturata*, though many of the skins are not perfectly determinable. One difficulty lies in the fact that the specimens from Moyobamba and nearby localities are nearly topotypical of *peruviana* but are somewhat closer to *saturata* taxonomically than are birds from the Ucayali, though some of the latter are hardly distinct. If *saturata* is to be recognized, its range includes all of eastern Ecuador, southeastern Colombia, and Perú north of the Amazon. Records not included in the subjoined list of specimens examined are from Pebas.

Hypocnemis cantator implicata, new subspecies

TYPE from Igarapé Auará (near Borba), Rio Madeira, Brazil. No. 279,549, American Museum of Natural History. Adult male collected February 25, 1930, by the Olalla brothers.

DIAGNOSIS.—Similar to *M. c. peruviana* but upper parts, especially of the females, less heavily marked, though more so than in typical *cantator;* wings and tail less rufescent than in *peruviana;* flanks slightly paler rufescent; females warmer (less grayish) brown above; middle of belly whiter in both sexes.

RANGE.—Lower Rio Madeira, Brazil; westwardly intergrading with *peruviana* and eastwardly with *striata*.

DESCRIPTION OF TYPE.—Top of head and neck with a central stripe of white, bordered laterally on each side with a broad stripe of black; lores largely white, continued over the eye to the nape in a white superciliary stripe; lower part of lores dusky; a broad postocular stripe blackish; general color of mantle gray, most of the feathers with black or blackish shaft-stripes, often bordered on the inner margins of the feathers with a white or whitish edge, sometimes obsolete; an extensive patch of white concealed at the bases of the feathers; scapulars also with some blackish striping terminally; rump slightly more rufescent than Brussels Brown. Throat white, with fine, blackish, hairlike tips; breast similar, with blackish tips broader and with some dusky shaft-lines near the tips; sides of the breast white, with broad blackish shaft-stripes; middle of belly white on upper portion, tinged with yellow posteriorly; flanks and under tail-coverts Mars Yellow x light Antique Brown; thighs buffy brown; remiges largely blackish with tertials and outer margins of primaries and secondaries Raw Umber x Dresden Brown; margin of outermost primary paler, buffy; tertials with traces of ochraceous tips, lesser upper wing-coverts blackish, with rounded white spots at tips; median series similar but with an olive-brownish tinge subterminally; greater series more rufescent brownish with terminal spots larger and buffy; primary-

coverts rufous brown, with slightly paler tips; alula with outer margin broadly white; under wing-coverts buffy white; inner margin of remiges Cartridge Buff. Tail rufous Brussels Brown, with buffy tips and dusky subterminal bars, obsolete on the middle pair, broadest on outermost. Maxilla blackish (in dried skin); mandible whitish; feet dull grayish-brown. Wing, 57 mm.; tail, 40.5; exposed culmen, 14; culmen from base, 17.75; tarsus, 20.

REMARKS.—Females with central stripe on top of head and neck pale buff; lateral stripes Raw Umber, the feathers each with blackish shaft-lines which are much broader on the posterior ones; superciliary stripes becoming buffy posteriorly; mantle Dresden Brown x Brussels Brown, with not very prominent buffy marginal stripes on inner webs near the tips of the feathers and dusky subterminal stripes on the shafts; very slight traces of white concealed near the bases of the interscapular feathers. Buffy tips and blackish subterminal spots on tail somewhat less conspicuous than in the male. Pale terminal spots on lesser and median upper wing-coverts buffy white; those on greater series orange-buff. Sides of breast tinged with buff. Otherwise about like the males in coloration and size.

Females from Rosarinho, left bank of the Madeira, show approach toward *peruviana* in the slightly more pronounced dusky markings on the upper surface which, in turn, is a trifle grayer brown than in birds from the east bank. The males have the ground color of the upper surface somewhat less rufescent in tone. Both sexes show the belly frequently tinged with yellow. The general characteristics, however, remain those of *implicata.*

Skins from Villa Bella Imperatríz, between the Madeira and the Tapajoz rivers on the south bank of the Amazon, show a distinct tendency toward *striata* of the Tapajoz, but they are closer to *implicata,* while birds from the left bank of the Tapajoz are unquestionably referable to *striata.* It is unusual to find the separation between two subspecies taking place between two of the adjacent major rivers such as the Madeira and the Tapajoz; usually the river forms the dividing line. Occasionally, however, the distinction occurs as shown here.

One of the interesting things about the present form is the apparent regularity of its variation in the direction of the adjacent conspecies as it approaches their ranges. It is not, however, an intermediate between *striata* and *peruviana* in its general appearance so much as between *striata* and *cantator.* It reaches its highest development on the east bank of the lower Madeira but varies one way or another as it extends east or west of that particular region. Southward, it appears to reach the lower portion of the Rio Roosevelt. A male and a female from the Infernas

Rapids seem to belong to *implicata*, though a female from higher up the river at "Camp 9" (Roosevelt Expedition) is quite different and inseparable from the Matto Grosso form which is described later in this paper.

Hypocnemis cantator striata (Spix)

Thamnophilus striatus Spix, 1825, 'Av. Bras.,' II, p. 29, Pl. xl, fig 2; no locality (I suggest Santarem); (♀); type lost.

Fifteen males and ten females from both banks of the Tapajoz show such marked differences from examples from all other localities that their recognition as a distinct subspecies becomes desirable. The males have the mantle as deeply black as the head and have the hind neck and anterior part of the mantle not duller or grayer; the white of the concealed interscapular patch is extensive and is continued along the inner margin of the feathers in a sharply defined white border reaching nearly to the tips of the feathers; the rump is dark (though dull) rufescent brown; the wings and tail are noticeably rufescent brown; the subterminal blackish spot on the rectrices is strongly developed; the dusky tips and shaft-lines on the breast are unusually heavy and blackish. The females are quite strongly and sharply streaked (not spotted) on the back with broad black shaft-streaks on somewhat rufescent brown ground; the rump is relatively rufescent; the wings and tail are more rufescent than in the males; the central stripe of the head is deep buff and the lateral stripes are rufescent brown with blackish shaft-stripes; the general appearance is distinctly brownish, much warmer and less grayish on the whole upper head and mantle than *peruviana*.

In looking for an available name for these birds, I was struck by the appropriateness of that given by Spix to a specimen which he obtained on his travels in Brazil. Since the specimen seems to have disappeared, it is not available for examination, but the description and even the poor figure which Spix gave in his account of the birds of Brazil are in better agreement with the east-Tapajoz birds than with those of other regions. The characterization of "supra rufescens, rufofulvo nigroque maculatum vel variegatum" does not fit *cantator*, *implicata*, nor *peruviana* but it does fit the birds under discussion. The figure of Spix's type shows a bird with a brown mantle streaked with black, though the streaks are not so pronounced as in the females at hand; neither are the streaks shown on the head as well defined as they actually are in the females of any of the conspecies of *cantator*. Since Spix visited Santarem whence I have examined various specimens, there is reason to believe that he may have secured the form there to which I believe his name is applicable.

Probably the range of *striata* extends eastward to the left bank of the Xingú. I have seen no specimens from that far to the eastward. Across the Xingú, another conspecies is found which I describe hereunder.

Hypocnemis cantator affinis, new subspecies

Type from Baião, Rio Tocantins, Brazil. No. 248,893, American Museum of Natural History. Adult male collected December 23, 1931, by Alfonso M. Olalla.

Diagnosis.—Very similar to *H. c. implicata* (from whose range it is separated by the interposition of *striata*); males slightly more strongly streaked with white on the mantle and with the scapulars and inner greater wing-coverts more pronouncedly rufescent or brownish; females with even less evident traces of buffy marginal streaks on the mantle than in the females of *implicata*, and no dusky shaft-stripes; remiges slightly more rufescent in both sexes.

Range.—Rio Xingú (right bank) to the Rio Tocantins, Brazil.

Description of Type.—General description as for type of *H. c. implicata* (antea, p. 11) but general tone of mantle noticeably brown except for the black-and-white area which may be restricted to the center of the interscapulars; scapulars more uniform and brownish; whitish borders of the central interscapulars more often reaching practically to tips of feathers. Wing, 55 mm.; tail, 40; exposed culmen, 13.25; culmen from base, 17.5; tarsus, 20.75.

Remarks —Females about as described for females of *H. c. implicata* but mantle more uniform brown with very faint traces of a short buffy line on the inner margins near the tips of a few feathers and no dusky subterminal shaft-streaks.

This form is so nearly like some skins of *implicata* that the characters might be considered of doubtful significance if it were not for the separated ranges. Nevertheless, the differences appear to be fairly constant, and sometimes pronounced. It is impossible to confuse either *affinis* or *implicata* with *striata* which occupies the intervening area except where *implicata* approaches the range of *striata* and there acquires certain intermediate characters. Since I have no specimens from the left bank of the Xingú, I am unable to say whether a certain intermediacy between *striata* and *affinis* may not obtain in that area.

Hypocnemis cantator ochrogyna, new subspecies

Type from Tapirapoan, Matto Grosso, Brazil. No. 127,151, American Museum of Natural History. Adult male collected January 17, 1914, by George K. Cherrie; original number 17,752.

Diagnosis.—Separable from all other known subspecies of *cantator* by the light ochraceous brown color of the upper parts of the females; both sexes with flanks averaging paler rufous than in most of the other races, darker than in *flavescens*, *subflava*, and *collinsi;* males somewhat like those of *similis* but with less rufous wings and tail, and with rather more black on the mantle, which usually is more prominently streaked with white.

RANGE.—Western Matto Grosso, Brazil, near the headwaters of the Rio Sepotuba and Rio Roosevelt; probably also the upper Rio Madeira and northeastern Bolivia.

DESCRIPTION OF TYPE.—Median stripe of the top of the head and neck, superciliaries, and lores Clay Color x Cinnamon-Buff; forehead largely deep Clay Color; broad lateral stripes on top of head and neck dark Sudan Brown with blackish shaft-lines, broadest on posterior feathers; auriculars Pinkish Buff; anterior malar region buffy white; dusky submalar line inconspicuous. Back bright Dresden Brown with suggestions of dusky shaft-spots on some feathers and a few subterminal stripes on the inner margins; rump and upper tail-coverts brighter (Buckthorn Brown x Antique Brown). Throat white with faint, dusky, hairlike tips; sides of throat tinged with buff; breast buffy white with dusky terminal margins heavier than on throat; sides of breast light Pinkish Buff with dusky terminal margins and broad blackish shaft-stripes; abdomen buffy white; flanks and under tail-coverts deep Ochraceous-Buff. Remiges Olive-Brown, margined exteriorly with Dresden Brown x pale Brussels Brown; tertials with suggestions of buffy tips; lesser upper wing-coverts blackish brown with pale buffy tips; median series browner and greater series still browner, both with pale buffy tips; under wing-coverts buffy white; inner margins of remiges Pale Ochraceous-Buff; tail light Brussels Brown with buffy tips. Wing, 56 mm.; tail, 41; exposed culmen, 13; culmen from base, 17; tarsus, 21.

REMARKS.—Males in general are as described for *H. c. implicata* but mantle with very pronounced black shaft-stripes bordered on the inner margins of the feathers with white, on the outer margins with brownish gray; anterior portion of mantle with less black and white and with more gray; margins of remiges and tail near Dresden Brown; flanks pale as in the female; breast moderately heavily streaked.

A male and a female from the upper Rio Roosevelt are slightly different from the Tapirapoan skins but are easily referable to the same form as distinguished from the other conspecies. Both have the flanks slightly deeper in color and the markings on the breast somewhat heavier. On the other hand, a pair from the lower Rio Roosevelt are more like *implicata* which inhabits the east bank of the lower Rio Madeira into which the Rio Roosevelt empties. I have not seen specimens from the upper Rio Madeira, but Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 241, footnote *b*, 1924) notes the pale flanks of birds from this region and from Yuracares, Bolivia, which would seem to indicate association with the present form.

The exact locality meant by "Yuracares" is somewhat in doubt. D'Orbigny obtained the specimen in what he designated as the territory of the Yuracares Indians north of Cochabamba. On his travels from Cochabamba to this region he descended into the lowlands and wandered as far northward as Trinidad on the Mamoré. Since the skin, as reported by Hellmayr, agrees with the upper Madeiran birds, and since

twelve skins from a little farther south, on the Chaparé, are all of another form, it seems probable that "Yuracares" is north of the Chaparé. In any case, there are no records of so-called *cantator* from the Chaparé or south of it in Bolivia. The Chaparé form is discussed under the name *collinsi*.

Hypocnemis cantator collinsi Cherrie

Hypocnemis collinsi Cherrie, 1916, Bull. Amer. Mus. Nat. Hist., XXXV, p. 395—Todos Santos, Río Chaparé, Bolivia; ♂; Amer. Mus. Nat. Hist.

Comparison of eighteen skins from Todos Santos, Bolivia, and southeastern Perú with a pair of *H. f. subflava* from Perené, Chanchamayo Valley, Perú, has shown certain differences which point to the validity of *collinsi*. The males are not sharply distinguishable, but the Chanchamayo specimen has the back of the neck and, to a lesser extent, the sides of the neck more strongly tinged with yellow; the remiges and rectrices are slightly more rufescent; the small, dusky, subterminal spots on the rectrices more pronounced and sharply defined; many of the interscapulars have both margins equally pale, making the streaking more distinct; the general tone of the back is more brownish, less grayish, olive; and the bill is somewhat more slender, though I suspect this last character to be an individual one.

The females offer better characters than the males, as is the case in most of the other conspecies. In *collinsi* the mantle has only obsolete dusky streaks but in the female of *subflava* there are very pronounced, broad, black streaks, almost as heavy as those of the male but with duller, brownish buff margins and only a faint trace of the pale yellowish interscapular patch; the margins of the mantle feathers are brighter, less grayish, than the corresponding portions of *collinsi*, and the wings and tail are warmer in tone; the pale central stripe of the head is a little whiter and more sharply defined; the sides of the breast are more heavily streaked; the flanks are slightly deeper in tone and more prominently streaked.

A female from the Río Colorado, Chanchamayo, in the Field Museum of Natural History, agrees in all of these characters with the Perené female, though it is in very poor condition and somewhat difficult to compare. Most of the interscapulars are missing and the relatively unmarked scapulars give a false impression that the back is unstreaked, but the few interscapulars that remain show the broad streaks of *subflava*. The other features are more readily discernible and substantiate the distinction of *subflava* and *collinsi*.

In both sexes the tone of rufescence is a little deeper (less ochraceous) than in *collinsi* from Bolivia, but the birds from southeastern Perú are intermediate in this respect. Similarly the southeast-Peruvian skins are intermediate in respect to the size of the bill, but in general coloration they are decidedly referable to *collinsi*. There is no zonal connection between the Chanchamayo Valley and southeastern Perú by which the ranges of *subflava* and *collinsi* can join except by way of territory inhabited by *peruviana* where that form alone has been found It seems, therefore, that *collinsi* and *subflava* are distinct geographically as well as morphologically.

While the association of *subflava* (and *collinsi*) with *flavescens* is obvious enough to require no further discussion, the same position of these three with reference to *cantator* has not been demonstrated heretofore. Nevertheless, I believe that this is the correct interpretation of the facts. The ranges of *flavescens* and of *subflava* and *collinsi* are separated by nearly the entire width of the Amazonian basin, and the existence of a geographically connectant form is highly probable. Such a form is found in *cantator*. The only other possible connectant is *hypoxantha*, but the available material of that group appears to show that it occurs in some localities with *flavescens*, though possibly in different ecological associations (cf. account of *H. h. hypoxantha*). In one of its subspecies it also occurs with one of the subspecies of *cantator* between the Tapajoz and the Xingú, which precludes the specific unity of these two groups.

In any case, the resemblance between the *cantator* and *flavescens* groups is closer than between *hypoxantha* and *flavescens*. Aside from the yellowish color of the under side of *flavescens* where *peruviana* is white, these two forms may be matched rather exactly in the material at hand; the upper sides of the two can be matched with no differences even in color. In *peruviana*, the yellowish tone of the abdomen in most specimens suggests the yellow of *flavescens*, though it does not reach the depth of tone shown by that form. With the other members of the *cantator* group, including *subflava* and *collinsi*, there is not the same similarity, but if the conspecific relationship of *flavescens* and *peruviana* is admitted, the other forms join the enlarged group through their relationship to these two conspecies.

Records from Perú which must belong to *collinsi* are from Yahuarmayo, Chaquimayo, Callanga, and Marcapata, and include also those of the Río Tavara and La Pampa skins now before me.

Hypocnemis cantator subflava Cabanis

Hypocnemis subflava Cabanis, 1873, Journ. f. Orn., XXI, p. 65—Monterico, Río San Miguel, Perú; ♂; Warsaw Mus.

I have a male and a female of this form from Perené, Chanchamayo Valley, Perú, and have examined, in addition, a male and a female from the same general region. The Chanchamayo Valley and the Río San Miguel (the type locality) are in adjacent drainage systems which unite to form the Ucayali, and specimens from the two regions are most likely to represent the same form. No females are known from the type locality, but the two I have examined from the Chanchamayo region agree with each other in the pronounced dorsal streaking in distinction from the more uniformly colored females of *collinsi* from extreme southeastern Perú and Bolivia (see account of *collinsi*).

The only additional record of this form is from La Merced, virtually identical with Perené and Río Colorado.

Hypocnemis cantator flavescens (Sclater)

Formicivora flavescens Sclater, 1865, Proc. Zool. Soc. London, "1864," p. 609—Marabitanas, Rio Negro, Brazil; ♀; British Mus.

A long series of one hundred and sixty skins from the Rio Negro and Rio Uaupés, Brazil, adjacent parts of the Uaupés in Colombia, and the upper Orinoco and Mt. Duida regions of Venezuela, permits a clear view of the characters of this form. There is considerable variation in the depth of coloration and in the alternate predominance of streaks and terminal bars in the dusky markings of the under parts. Although none of the skins shows the yellow of the under parts to be as pale or as largely replaced by white as it is in *peruviana* and *occidentalis*, in other respects it is possible to match skins of these three conspecies almost exactly. Since the strong tinge of yellow as shown on *peruviana* and *occidentalis* is not found in the east-Brazilian forms, it may be considered as constituting an intermediate character between the white of these forms and the yellow of *flavescens*.

Since *occidentalis* is found on the Caquetá and *flavescens* on the Uaupés, both in Colombia, it is probable that the ranges of these two may find their closest approximation on the Apoporis. Specimens from that region would, at least, be extremely interesting.

Hypocnemis cantator cantator (Boddaert)

Formicarius cantatar (err. typ.) Boddaert, 1783, 'Tabl. Pl. Enl.,' p. 44—based on "Le Carilloneur de Cayenne" of Daubenton, 'Pl. Enl.,' 700, fig. 2.

Five skins from Dutch and French Guiana and twenty-three from Obidos, Faro, and Manaos are at hand. Contrary to the usual account of this subspecies, all but two of the males of this series have a considerable patch of white concealed at the bases of the interscapular feathers; the dusky markings on the mantle, visible externally, are less prominent than in all other conspecies and are more in the nature of spots than streaks. The females also are very lightly marked above and are similarly spotted rather than streaked.

In the Amazonian drainage, this subspecies ranges west as far as the right bank of the Negro and its affluent, the Rio Branco. It should be expected from somewhat farther west about to Santa Isabel, though it has not been found there by our expeditions.

Hypocnemis cantator notaea Hellmayr

Hypocnemis cantator notaea HELLMAYR, 1920 (October), Anz. Orn. Ges. Bayern, III, p. 19—Mer umé Mts., British Guiana; ♂; Frankfort Mus.

Forty-seven specimens from British Guiana show the distinctness of *notaea* to be not always pronounced. Most of the specimens can be separated from the average *cantator* but some of them are not readily recognizable. On the other hand, a male of *cantator* from Pied Saut, French Guiana, is more deeply rufescent brown on the posterior parts than most *notaea*, and has the white patch of the interscapulars fully as well developed. The males of *notaea* usually have the back streaked more than in *cantator* and with more whitish margins on the feathers of the mantle, but the back is often only spotted and with gray margins; the concealed white patch on the mantle is usually larger but sometimes not so; the rufous tones of flanks, crissum, and rump are usually deeper and more intense than those of the same regions in *cantator*, but this also is not constant. However, most of the forms of *cantator* are subject to considerable individual variation which prevents the drawing of sharp lines, and since there is an average difference between this form and its conspecies it may be entitled to similar recognition.

SPECIMENS EXAMINED

H. c. notaea. BRITISH GUIANA: Potaro Landing, 3 ♂, 7 ♀; Tumatumari, 13 ♂, 8 ♀; Minnehaha Creek, 2 ♂; Rockstone, Essequibo River, 1 ♂, 1 ♀; Essequibo River, 1 ♂, 1 ♀; Kamakusa, 3 ♂, 2 ♀; Demerara, 2.

H. c. cantator.- FRENCH GUIANA: Approuague River, Ipousin, 1 ♂; Pied Saut, 1 ♂; Tamanoir, 1 ♀. DUTCH GUIANA: Paramaribo, 2 ♂. BRAZIL: Faro, 9 ♂, 6 ♀; Manaos, 4 ♂, 3 ♀; Obidos, 1 ♂; Conceição, Rio Branco, 1 ♂[1], 1 ♀[1].

[1]Specimens in Field Museum of Natural History, Chicago

H. c. affinis.—BRAZIL: Baião, Rio Tocantins, 3 ♂ (incl. type), 2 ♀; Cametá, 1 ♂; Tapará, Rio Xingú, 3 ♂, 1 ♀, 1 (?); Villarinho do Monte, 1 ♂.

H. c. striata.—BRAZIL: Santarem, 1 ♂, 1 ♀, 1 ♂[1], 1 ♀[1]; Tauarý, Rio Tapajoz, 3 ♂, 4 ♀; Aramanáy, 1 ♀; Igarapé Brabo, Rio Tapajoz (left bank), 5 ♂, 3 ♀; Igarapé Amorín, 2 ♂; Limoãl, 1 ♂; Boim, 1 ♂; Santa Elena, Rio Xamauchim, 1 ♀.

H. c. implicata.—BRAZIL: Igarapé Auará, 3 ♂ (incl. type); Santo Antonio de Guajará, 1 ♂, 2 ♀; Borba, 5 ♂, 2 ♀; Infernas Rapids, Rio Roosevelt, 1 ♂, 1 ♀; Villa Bella Imperatríz, Rio Amazonas, 7 ♂, 3 ♀; Rosarinho, Rio Madeira (left bank), 16 ♂, 12 ♀.

H. c. ochrogyna.—BRAZIL: Tapirapoan, Matto Grosso, 3 ♂, 1 ♀ (type); Morinho Lyra, 1 ♂; "Camp 9," Rio Roosevelt, 1 ♀.

H. c. collinsi.—BOLIVIA: Todos Santos, 9 ♂, 3 ♀. PERÚ: La Pampa, 2 ♂, 1 ♀; Río Tavara, 2 ♂, 1 ♀.

H. c. subflava.—PERÚ: Perené, 1 ♂, 1 ♀; Río Colorado, 1 ♀[1]; Chanchamayo, 1 ♂.[1]

H. c. peruviana.—PERÚ: Río Seco, w. of Moyobamba, 4 ♂, 2 ♀, 1 (?); Río Negro, w. of Moyobamba, 2 ♂; Moyobamba, 3 ♂[1], 1 ♀[1], 1 (?)[1]; Puerto Bermúdez, 1 ♂[1]; Lagarto, Río Ucayali, 8 ♂, 4 ♀; Sarayacu, 12 ♂, 10 ♀; Orosa, Río Amazonas, 1 ♂, 3 ♀. BRAZIL: Teffé, 6 ♂, 5 ♀.

H. c. saturata.—PERÚ: Puerto Indiana, 9 ♂, 5 ♀; Apayacu (=Anayacu), 1 ♂, 1 ♀. ECUADOR: Mouth of Río Curaray, 7 ♂, 3 ♀; mouth of Lagarto Cocha, 1 ♀; below San José, 2 ♂, 1 ♀; lower Río Suno, 2 ♂, 1 ♀; Río Suno above Avila, 3 ♂ 3 ♀; Zamora, 4 ♂, 6 ♀. COLOMBIA: La Morelia, 3 ♂, 1 ♀.

H. c. flavescens.—COLOMBIA: Río Uaupés, opposite Tahuapunto, 1 ♀. BRAZIL: Rio Uaupés, Tahuapunto, 2 ♂, 3 ♀; Rio Negro, Mt. Curycuryari, 2 ♀; Yucabi, 2 ♂, 1 ♀; Camanaus, 1 ♀; San Gabriel, 3 ♂, 4 ♀; Santa Isabel, 1 ♂, 2 ♀. VENEZUELA: Mt. Duida, upper Orinoco, Río Cassiquiare, etc., 128 skins of both sexes; La Union, Río Caura, 3 ♂, 1 ♀; Suapuré, 2 ♂, 1 ♀; Boca de Sina, 1 ♀; Río Caura, 1 ♂; mouth of Río Chanaro, 1 ♀.

Hypocnemis hypoxantha hypoxantha Sclater

Hypocnemis hypoxantha SCLATER, 1868, Proc. Zool. Soc. London, p. 573, Pl. XLIII—Upper Amazons; ♂; British Mus.

In a series of thirty-seven skins from both sides of the Amazon in Perú, eastern Ecuador, eastern Colombia, and the right bank of the Rio Negro in Brazil, I can find no positive differences worthy of recognition by a separate name. The females from the Rio Negro, Brazil, may be a trifle browner on the back than the Peruvian birds, but the difference is not notable and the males are inseparable. Incidentally, the Rio Negro specimens extend the known range of this subspecies far to the eastward but not far enough to adjoin the area inhabited by the single conspecies *ochraceiventris*.

There appear to be various conflicts between this species and *cantator* in their distribution so that, although *hypoxantha* seems to fill

[1]Specimens in Field Museum of Natural History, Chicago.

a hiatus in the known distribution of the forms of *cantator*, there is too much overlapping to permit the specific association of these two groups.

There is a specimen of *h. hypoxantha* from Mt. Curycuryari at an elevation of 2500 feet, and there are two skins of *c. flavescens* from the same mountain at an elevation of only 500 feet, but both localities are in the Tropical Zone. From northwest of the mountain, at Yucabi, there are several skins of *flavescens* and others from the Rio Uaupés, while there are various skins of *hypoxantha* from Tatú at the mouth of the Uaupés above Yucabi. Thus, while both forms were not secured at identical spots, the localities for each are so intermixed that the ranges must overlap unless there are ecological associations which might segregate different habitats throughout the same general area. Thus *H. h. hypoxantha* appears to overlap *c. flavescens* in the vicinity of Mt. Curycuryari, Brazil, and merges with the range of *c. saturata* and *c. peruviana* in eastern Ecuador and eastern Perú, while *H. h. ochraceiventris* and *c. striata* occupy, in part at least, the same region of the lower Amazon in Brazil. Unless some distinctness can be shown in the ecological preferences of the two groups where they occur together, it will be impossible to unite them specifically.

Hypocnemis hypoxantha ochraceiventris Chapman

Hypocnemis hypoxantha ochraceiventris CHAPMAN, 1921, Amer. Mus. Novit., No. 2, p. 5—Altamira, Rio Xingú, Brazil; ♂; Mus. Goeldi.

A number of additional specimens from the east bank of the Rio Tapajoz confirm the characters of this excellent subspecies.

SPECIMENS EXAMINED

H. h. hypoxantha.—PERÚ: mouth of Río Urubamba, 1 ♂, 2 ♀; Apayacu (=Anayacu), 7 ♂, 2 ♀. ECUADOR: mouth of Río Curaray, 1 ♀. COLOMBIA: La Morelia, 1 ♀. BRAZIL: Tabocal, Rio Negro, 1 ♂; Tatú, 8 ♂, 3 ♀, 2 ?; Yavanari, 1 ♂; Mt. Curycuryari (2500 ft), 1 ♀; Igarapé Cacao Pereira, 2 ♂, 4 ♀; Mirapinima, 1 ♀.

H. h. ochraceiventris.—BRAZIL: Altamira, Rio Xingú, 1 ♀ (paratype); Tauarý, Rio Tapajoz, 1 ♂; Piquiatuba, Rio Tapajoz, 2 ♂, 1 ♀; Caxiricatuba, 3 ♂, 1 ♀.

Hypocnemoides melanopogon occidentalis, new subspecies

TYPE from Puerto Indiana, Río Amazonas, Perú. No. 231,905, American Museum of Natural History. Adult female collected July 1, 1926, by Carlos Olalla and sons.

DIAGNOSIS.—Similar to *H. m. melanopogon* from Guiana but males duller bluish-gray on the back, darker gray on the breast and flanks, and decidedly less whitish on the abdomen; females duller gray above, with the throat feathers usually much

more strongly tipped with dark gray and with broader gray bases, giving the throat a distinctly (sometimes very heavily) barred appearance; breast-feathers more broadly tipped with dark gray and with the terminal band usually extended backward on both lateral margins, leaving a central, rounded spot of white or buffy white; flanks darker and more broadly olive grayish.

RANGE.—Río Napo in Perú and Ecuador, extending northeastward to the upper Rio Negro (right bank), Brazil, and, in a modified degree (approaching typical *melanopogon*), into southeastern Venezuela as far as the Caura Valley; southward reappearing on the upper Ucayali.

DESCRIPTION OF TYPE.—Upper surface mostly dull Slate Gray; lores faintly whitish; auriculars Slate Gray with shafts basally white; malar region, chin, and throat subterminally whitish, with broad gray tips (Deep Neutral Gray x Iron Gray) and gray bases, giving a distinctly barred appearance to the area; breast-feathers with pale guttate centers (slightly buffy), margined terminally and laterally with brownish gray, somewhat tinged with buff on lower breast where the central spots are less sharply defined; sides of breast more uniform brownish gray; flanks like sides, broadly brownish gray; middle of belly narrowly whitish; under tail-coverts pale buffy. Remiges brownish black, externally margined with dark bluish gray and with a broad terminal band and a black subterminal bar; alula with broad white outer margin; under wing-coverts dull, pale brownish, more grayish near the carpal edge of the wing; inner margins of primaries whitish. Tail blackish, with white tips on the rectrices about 1 mm. wide; upper tail-coverts blackish with faintly bluish gray margins. Maxilla and feet blackish brown (in dried skin); mandible whitish. Wing, 60 mm.; tail, 31; exposed culmen, 15; culmen from base, 18.25; tarsus, 19.

REMARKS.—Males like the females above and on the wings; lores not touched with white but slaty gray; auriculars gray, without white shafts; malar region gray; chin and throat sooty black, forming a patch which is graduated rather abruptly into the Dark Gull Gray x Slate-Gray of the breast, sides, and flanks; belly Dark Dull Gray x Deep Gull Gray, in young birds paler than the breast (sometimes Gull Gray in young birds) with very faint indications of paler tips not always distinguishable; under tail-coverts like the belly, with white tips more pronounced; entire bill brownish black. Size same as that of the females.

The series of females exhibits a certain amount of variation which becomes more pronounced and shows more frequent departure from the standard of the type the greater the distance from the type locality to the northeastward. The birds from Perú and Ecuador are the most strongly marked (except one young female which is distinctly lighter than the others though still separable from *melanopogon*). Birds from the west bank of the upper Rio Negro and the Rio Uaupés in Brazil are more like the paler Peruvian specimens, and skins from Venezuela are like the paler Brazilian examples. Some of the most lightly marked females from Venezuela are not very distinct from the same sex of typical *melanopogon* but others are not greatly different from the light-

est Peruvian females and the males from the same region retain the darker belly of *occidentalis*. If a larger series from Perú and Ecuador should show a great preponderance of the extremely heavy coloration of the type and some of the paratypes, it might prove desirable to recognize a separate subspecies from the Venezuelan region but at present there is just enough overlapping of characters to render this course of doubtful advisability.

A most interesting discovery has been that of the presence of pure silky white on the interscapulars of some of the specimens from Venezuela. Many of the skins of both sexes from this and other regions have the bases of the interscapulars very pale gray contrasting sharply with the slaty gray of the tips, and often with a dusky mark between the two contrasting areas. In addition, two males and three females show varying amounts of definite white, contrasting with the pale gray of the bases of the feathers and of the same nature as, though of lesser extent than, that in the allied species, *H. maculicauda*. The amount of white on the tips of the rectrices does not, however, show a corresponding increase toward the greater extent exhibited by *maculicauda*.

These are the first records of a form of *melanopogon* from Perú or Ecuador. The skin from Lagarto, upper Ucayali, is particularly interesting since it comes from an area apparently cut off from the principal range of *occidentalis*. Between Lagarto and Puerto Indiana, on the north bank of the Amazon, lies nearly the entire course of the Ucayali, inhabited by *maculicauda*, and yet the Lagarto specimen is one of the most heavily marked of the examples of the new form, though not fully adult. It can not be referred to *maculicauda*. More material from this region might help to a better understanding of this divided range, but at present the skin must be referred to *occidentalis*.

H. m. melanopogon approaches the range of *occidentalis* most closely on the Rio Negro in Brazil. Spreading southward from the Guianas, *melanopogon* extends westward along the left bank of the upper Rio Negro to San Gabriel, across the Negro from part of the area occupied by *occidentalis*. A series of both sexes from the right bank of the Negro near its mouth (Mirapinima and Igarapé Cacao Pereira) definitely belongs to *melanopogon* and shows that this form crosses the river somewhere between its mouth and the junction of the Branco.

South of the Amazon, *melanopogon* occurs between the Tocantins and the Xingú and again between the Tapajoz and the Purús, leaving the region from the right bank of the Tapajoz to the left bank of the Xingú to be occupied by *maculicauda*, as is the Pará District to the right

of the Tocantins. With a single exception, I know of no records of the two species from the same locality. The exception is that of Cachoeira, upper Purús, given by Madame Snethlage, who points out elsewhere that different habitats are favored by the two birds. It is possible that the two Cachoeira birds may not be exactly coincident. With this exception, the ranges of *maculicauda* and *melanopogon* interlace but do not overlap. This may be highly significant in view of the occurrence of white on the interscapulars of some *occidentalis* as recorded above.

I must confess to considerable doubts about the application of the name *melanopogon* (cf. Hellmayr, Novit. Zool., XIV, p. 381, 1907). Even though Sclater's original description was based largely on Guiana and Cayenne specimens, it included a description (however incomplete) of a skin from Chamicuros, Peru, which is the only locality mentioned in the original account. It is difficult to see how even the author himself is empowered subsequently to designate as type a specimen from outside the originally cited range of his species. That Sclater had doubts about the propriety of this action is, I think, shown by his still later citation of the Chamicuros bird as type ('Cat Birds Brit. Mus.,' XV).

However, there is no explicit rule covering the case and some confusion undoubtedly would result from transferring the name *melanopogon* to the bird found at Chamicuros, now known as *maculicauda*. Consequently, I shall adhere for the present to the nomenclature now current for the two forms in question.

Specimens Examined

H. m. melanopogon.—British Guiana: Tumatumari, 3 ♂; Rockstone, Essequibo River, 1 ♀. Dutch Guiana: Lelydorp, 1 ♂; Paramaribo, 1 (?). Brazil: Faro, 6 ♂, 2 ♀, 1 (?); Rio Negro, Mirapinima, 5 ♂, 5 ♀, 1 (?); Igarapé Cacao Pereira, 1 ♂; Santa Isabel, 1 ♂, 1 ♀; San Gabriel, 2 ♀; Rio Tocantins, Baião, 4 ♂, 3 ♀; Ilha Pirunhum, 1 ♀; Arumatheua, 1 ♀; Mocajuba, 1 ♂, 2 ♀; Rio Xingú, Tapará, 1 ♂, 3 ♀; Villarinho do Monte, 5 ♂; Limoãl, 1 ♀; Caxiricatuba, 1 ♂; Rio Amazon (south bank), Villa Bella Imperatriz, 5 ♂, 3 ♀; Rio Madeira, Igarapé Auará, 1 ♂, 1 ♀; Borba, 3 ♂, 1 ♀; Rosarinho, 1 ♂, 3 ♀.

H. m. occidentalis.—Perú: Puerto Indiana, 2 ♂, 6 ♀ (incl. type); Lagarto, upper Ucayali, 1 ♀. Ecuador: mouth of Río Curaray, 1 ♂. Brazil: Rio Negro, Yavanari, 1 ♂, 3 ♂; Tabocal, 1 ♀, 1 (?); Rio Uaupés, Tahuapunto, 1 ♂, 1 ♀. Venezuela (not typical): Río Cassiquiare, Mt. Duida, and upper Orinoco, 95 skins of both sexes; La Cascabel, Río San Feliz, 1 ♂; Suapuré, 2 ♂; La Unión, Río Caura, 2 ♂.

Hypocnemoides maculicauda (Pelzeln)

Hypocnemis maculicauda PELZELN, 1868, 'Orn. Bras.,' II, p. 164—Villa Maria (= San Luis de Caceres), Matto Grosso, Brazil; Vienna Mus.

With the small series of this form available for study, even though a variety of localities is represented, it is not possible to form a satisfactory judgment regarding its affinities, distribution, and variations. The females from the Tapajoz appear to be slightly paler above than the Peruvian females and to have lighter, less conspicuous lunules on the breast and less noticeable dark tips on the feathers of the throat. The single female from Matto Grosso, which is the most nearly topotypical one, is not in very good condition and is exactly intermediate in characters, having the throat unmarked but the breast feathers heavily tipped, while the back also is dark.

The Tapajoz males are slightly paler above than the Matto Grosso male (the Peruvian male is immature), but a male from Bolivia (not quite adult) is like the Tapajoz specimens There is no difference in the amount of white on the tips of the rectrices in the birds of either sex from all parts of the range, though Hellmayr (Field Mus Nat Hist. Publ., Zool. Ser., XIII, pt. 3, p. 246, footnote *a*, 1924) found indications of more extensive white in birds from the Tapajoz and Perú and of less extensive white in those from Matto Grosso and the Rio Machados, Brazil. A good series from the type locality will be necessary to determine whether the various differences noted indicate racial distinction or merely individual variation and, if the former, whether the Peruvian or the east-Brazilian extreme is to be referred to typical *maculicauda*.

The range of this species in Perú is fairly compact though curiously irregular. It embraces Nauta and Elvira on the north bank of the Marañón but does not extend much farther eastward on that bank of the river, being replaced on the Napo by *H. melanopogon occidentalis*. It crosses the Marañón to the east bank of the Huallaga at Chamicuros and thence extends eastward to the lower Ucayali and the Javari in Perú, and, in Brazil, to São Paulo de Olivença on the south bank of the Amazon. Near this point it appears to leave the vicinity of the Amazon and, for a space, to retire to the upper reaches of the rivers. It is recorded from the Juruá, from the upper Purús, the upper Guaporé, and the upper Paraguay rivers in Brazil, and is found on the Chimoré in Bolivia, avoiding that portion of the Amazonian basin west of the Tapajoz which is occupied by *H. m. melanopogon*. It then reappears between the Tapajoz and the Xingú, and again east of the Tocantins, but is not found between the Xingú and the Tocantins where *melanopogon* is again interposed.

Possibly the various localities all are connected in an irregularly outlined area, but as at present known they occur in detached and scattered groups, though there are no records of *melanopogon* to cut off the possible lines of communication. The only disturbing factor is the occurrence of *melanopogon occidentalis* on the upper Ucayali where it is cut off from the main part of its own range by the interposition of *maculicauda* on the lower Ucayali, but this problem exists regardless of the connected or disconnected range of *maculicauda*, so far as present information shows.

Further discussion of the relationship of *maculicauda* and *melanopogon* is given in the account of *H. melanopogon occidentalis*.

Peruvian records are from Chamicuros, Cashiboya, Río Javari, Nauta, and Elvira.

SPECIMENS EXAMINED

H. maculicauda.—BRAZIL: Descalvados, Matto Grosso, 1 ♂, 1 ♀; Rio Tapajoz, Tauarý, 1 ♂; Caxiricatuba, 2 ♀; Isla de Goyana, 1 ♀; Igarapé Brabo, 1 ♂. BOLIVIA: Mission San Antonio, Río Chimoré, 1 [♂]. PERÚ: Sarayacu, Río Ucayali, 1 ♂, 2 ♀.

Myrmochanes hemileucus (Sclater and Salvin)

Hypocnemis hemileucus SCLATER AND SALVIN, 1866, Proc. Soc. Zool. London, p. 186—lower Ucayali, Perú; ♂; British Mus.

Terenura melanoleuca PELZELN, 1868, 'Orn. Bras.,' II, p. 84—Borba, Rio Madeira, Brazil; ♂; Vienna Mus.

Myrmochanes hypoleucus ALLEN, 1889, Bull. Amer. Mus. Nat. Hist., II, p. 95—Reyes, Bolivia; ♂; Amer. Mus. Nat. Hist.

Up to date only five males of this species have been recorded and the female has remained unknown though three names have been given to the males from different localities. I have before me fourteen males, including the type of *M. hypoleucus* Allen and fourteen females from a number of regions and though little can be added to the known facts of distribution, various taxonomic details are worthy of comment.

The females resemble the males very closely but may be recognized by several peculiarities. The lower mandible is pale in the females, black in the adult males. The females have a broad white stripe from the nostril through the upper loral region to above the middle of the orbit; the adult males have the same region black or with only a suggestion of white behind the nostril. The adult males have a solidly black outer (upper) margin on the sides of the breast continuous with the black of the sides of the neck; the females have the margin narrower and

more or less broken into streaks. The adult males have the lower flanks and crissum pure white or lightly tinged with creamy buff; the females have this buffy tinge more pronounced. The crest on the head, the white patch concealed on the mantle, the white spots on wings and tail, and the size are alike in both sexes. Young males resemble the females, if the young birds at hand are correctly sexed, but have the buffy tone of the posterior under parts deeper, sometimes quite ochraceous.

It may be found necessary to recognize an eastern subspecies from the Rio Madeira, for which the name *melanoleuca* is available. The specimens from that region are purer white below with no buffy tone on the crissum of the adult males and not a very deep tone in the adult females. The type of *hypoleuca* from Bolivia agrees with the Rio Madeiran males. The Peruvian and Ecuadorian birds all show traces of ochraceous buff on the crissum, strongest in the females. Since this is also a criterion of age, it is better to let the final decision await an even larger series. There still remain uncertainties regarding the distribution of this species. The Rio Madeiran range is, no doubt, continuous with the Bolivian range through the Rio Beni, an affluent of the Madeira. The Ucayali and Napo ranges in Perú and Ecuador are connected across the upper Amazon. There is no information at hand, however, to show how the Bolivian and Peruvian ranges may come together, and it may well be that if *melanoleuca* is recognized, its range will remain separated from that of *hemileuca*.

SPECIMENS EXAMINED

M. hemileuca.—PERÚ: Lagarto, upper Ucayali, 1 ♂, 2 ♀; Santa Rosa, Ucayali, 1 ♂; Puerto Indiana, 2 ♂. ECUADOR: mouth of Río Curaray, 1 ♂, 4 ♀. BOLIVIA: Reyes (type of *M. hypoleucus*), 1 ♂. BRAZIL: Santo Antonio de Guajará, 8 ♂, 7 ♀, 1 (?).

AMERICAN MUSEUM NOVITATES

Number 539 | Published by The American Museum of Natural History New York City | June 15, 1932

59 57, 72 T (67 5)

THE TABANIDÆ OF THE AMERICAN MUSEUM CONGO EXPEDITION, 1909–1915[1]

By Joseph C. Bequaert[2]

Some years ago, the late Professor James S. Hine and I prepared an elaborate joint report upon the Tabanidæ of the Belgian Congo, including the material collected by the Lang-Chapin Expedition. Owing mainly to the fact that the collection was mislaid, this paper could not be published. Meanwhile much of it has become out-of-date or superfluous. The present short report merely enumerates the species obtained by the Congo Expedition of 1909–1915, with the addition of a few forms obtained by Dr. James P. Chapin on his recent journey to the Belgian Congo (1930–1931).

Of the original joint manuscript, only the description of *Tabanus brunneicollis* is reproduced here and that species should therefore be credited jointly to Prof. Hine and myself.

In 1930, I published a revision of the Tabanidæ of the Belgian Congo, including keys for the identification of genera and species ('The African Republic of Liberia and the Belgian Congo,' II, pp. 858–971). The list of the species and varieties known from that territory has since been increased to one-hundred and thirty-seven by the following additions:

Stenophara elongata (Ricardo) = *Pangonia elongata* Ricardo, 1908, Ann. Mag. Nat. Hist., (8) I, p. 54 (♀; Mt. Kilimanjaro, Tanganyika Territory). I have seen a male of this species taken at Kasenga, on the Luapula River, in April, 1931, by H. Bredo. It is also known from southern Abyssinia, Kenya Colony, and Northeastern Rhodesia.

Tabanus fulvianus Loew, 1858, Öfv. Kgl. Vet. Ak. Forh., Stockholm, XIV, (1857), p. 339 (♀; Caffraria). I have seen two females of this species from the Katanga District: one taken at Lubumbashi in November, 1928, by Ch. Seydel; the other at Elisabethville, December 17, 1930, by Michael Bequaert. A careful comparison of these two specimens with a female from Delarey, Transvaal (January 1, 1917; H. Brauns), failed to disclose appreciable differences. The species, curiously enough, was not seen again since Loew described it, unless it was confused with some similar form.

[1]Scientific Results of the Congo Expedition Entomology No 24.
[2]Department of Tropical Medicine, Harvard Medical School

Tabanus brunneicollis Hine and Bequaert, described in this paper. Type locality: Stanleyville.

Many of the most interesting tabanids listed in this paper were obtained by Mr. Herbert Lang while making observations on the habits of certain species of *Bembix*, as recorded in his subjoined field-notes.

When in Stanleyville, at the beginning of 1915, I found that the subsiding waters had exposed the sand-flats on the right bank of the Congo River just below Stanley Falls and also the more extensive sand deposits on the forested left bank of the Tshopo River, along the great curve below the falls. By the middle of February, fossorial wasps of the genus *Bembix* had taken up their abode on these sand-flats. Below Stanley Falls their number was restricted, perhaps due to disturbance by natives. Near Tshopo Falls, however, the more lonely site was apparently found ideal for a colony of several thousands of these wasps.

The female *Bembix* carried, as food for the young, freshly killed Diptera which were in perfect condition when taken from their captors. Representatives of many families were among the victims, such as Bombyliidæ, Syrphidæ, Stratiomyidæ, Muscoidea, etc.; but Tabanidæ were especially numerous, which was the more gratifying since I had tried in vain to gather these flies otherwise. When caught in the net the *Bembix* at once dropped its prey and, if released, would soon reappear on the scene with another fly. One wasp, recognizable by a slightly mutilated wing, within two hours returned to its nest with eleven flies. It was an unusual opportunity to profit by the activities of such busy collectors. Fortunately Dr. Joseph Bequaert happened to be in Stanleyville at that time, and we made several excursions together to the Tshopo Falls. His helpful information on the habits of *Bembix* and his generous encouragement caused me considerably to enlarge the Congo Expedition's collection of Diptera.

For this work I trained half a dozen native boys, providing them with nets and remunerating them according to the number of flies they brought in. Only during the hours of greatest sunshine was it worth while to attend these colonies, that is from 10 A.M. to 3 P.M. At other times the *Bembix* brought relatively few flies, being occupied rather with digging or clearing their tunnels which might have been closed by accident or rain. On rainy days they were not active, and after a number of dry days would also catch fewer flies. But the day following a rainy spell, prey was carried to the nest in considerable numbers. Evidently there was then greater need of food for the larvæ, which in the genus *Bembix* are gradually supplied with nourishment.

At Tshopo Falls the *Bembix* colonies were chiefly composed of two species. The smaller, less numerous form, *Bembix braunsii* (Handlirsch),[1] frequented only the higher lying, flatter, and harder portion of the sandy areas. They dived into their nests without much hovering about and were generally more evasive. Their burrows were fairly far apart and yielded but few flies.

The larger *Bembix*, *B. bequaerti* Arnold var. *dira* Arnold (1929, Ann. Transvaal Mus., XIII, pt. 4, p. 351), was the chief provider of our collection. This species reaches a total length of nine-tenths of an inch. The female is bluish steel-black with rather reduced yellow markings on the sides. The male is much more brightly colored,

[1]Determined by Dr. G. Arnold, of the Rhodesia Museum, Bulawayo.

yellow, with narrow, black, transverse stripes on the abdomen; the dorsal side of the thorax bears a broad and conspicuous, yellow, horsehoe-shaped design. This species was so numerous, that during the most favorable period, from the middle of February to April 10, several thousands were to be found in some colonies. Their nests were so close together, that at least thirty entrance holes could be swept with the net at any point. These wasps preferred the steeper portions of the bank with a slope of about 40° or 50°. Here the sand was loose, dry on top, and easily shifted under foot. At a depth of three or four inches, however, it was quite moist and made tunneling easy, as it kept in place. The moisture did not appear to increase at a depth of 45 inches, the length of the longest channels; yet it was sufficient to protect the larvæ and pupæ against the great variation in temperature that the short periods of dry and wet days cause near the surface. During the hours of sunshine, when hundreds of *Bembix* were digging in the most densely populated parts of the colony, it looked from a distance as if the sand were blown out in miniature clouds of dust from the many entrances.

Frequently on reaching the nest a *Bembix* had to lay aside the fly it was carrying in order to be free for digging. Sometimes the fly was accidentally buried in the sand thrown out and was then forgotten. Or perhaps another female pounced upon such momentarily abandoned prey. Occasionally, too, a homecoming female was rushed at by several yellow males competing for her possession, the group forming one whirling mass of wasps. Of course, a female thus held up usually dropped her fly at the very beginning of the tussle.

I collected also some of the tiny muscoid flies (*Idia* sp.) that not only follow a *Bembix* carrying prey but often enter its tunnels and stay inside from two to four minutes. According to Dr. Bequaert, they probably parasitize the *Bembix* larvæ or at least feed on the prey brought into the burrow by the female wasp. Certain small Carabidæ also have the habit of running into these passages and scurrying out again shortly after the *Bembix* enters. Apparently the same species of beetle is also found running about under the dead leaves near the edge of the sand-bank.

After April 10, 1915, the rising waters completely flooded the *Bembix* colonies, and great chunks of the sand-banks were eaten away, thus exposing many cocoons of the wasps. Huge waves from the falls at the period of intermittent rise and fall of the water washed away much of the sand from the banks, merely to redeposit it later when high water definitely set in as a result of the rainy season. From then on it was a waste of time to watch the *Bembix* colonies for flies.

The following is a list of the twenty-six species of Tabanidæ found by Mr. Lang at Stanleyville, among the prey of *Bembix bequaerti* var. *dira* G. Arnold. The large proportion of males taken by the wasps is noteworthy.

Dasycompsa cincta Enderlein. ♀ ♂
Tabanocella stimulans (Austen). ♀ ♂
Thriambeutes singularis Grunberg. ♀ ♂
" *austeni* (Hine). ♀ ♂
Subpangonia gravoti Surcouf. ♂
Chrysops griseicollis J. Bequaert. ♀
" *dimidiata* van der Wulp. ♀
gi J. Bequaert. ♀ ♂

Tabanus irroratus Surcouf. ♀
" *fasciatus* Fabricius. ♀
" *boueti* Surcouf. ♀ ♂
" *besti* Surcouf. ♀ ♂
" *obscurehirtus* Ricardo. ♀ ♂
" *obscurior* Ricardo. ♀ ♂
" *canus* Karsch. ♀ ♂
" *billingtoni* Newstead. ♀ ♂

Tabanus marmorosus var. *congoicola* J. Bequaert. ♀ ♂
" *obscurefumatus* Surcouf. ♂
" [*brunneicollis* Hine and J. Bequaert. ♀ ♂
" *variabilis* Loew. ♀
Tabanus socialis Walker. ♀ ♂
" *secedens* Walker. ♀ ♂
" *congoiensis* Ricardo. ♀ ♂
" *regnaulti* Surcouf. ♀ ♂
Thaumastocera akwa Grunberg. ♀ ♂
Hippocentrum strigipenne (Karsch). ♀ ♂.

Approximate Location of Localities Mentioned

Akenge, 2° 55′ N., 26° 50′ E.
Avakubi, 1° 20′ N., 27° 40′ E.
Bafwaboli, 0° 40′ N., 26° 10′ E.
Bagana, 8° N., 7° 40′ E.
Basoko, 1° 20′ N., 23° 35′ E.
Basongo, 4° 25′ S., 20° 30′ E.
Bayenga (Uele-Nepoko)
Benin, 6° 20′ N., 5° 40′ E.
Benue (R.), 8° N., 7° to 10° E.
Bolengi, 0° 5′ S., 18° 10′ E.
Bolobo, 2° 15′ S., 16° 15′ E.
Buddu, 1° S., 32° E.
Bumba, 2° 10′ N., 22° 30′ E.
Chinchoxo, 5° 15′ S., 12° 15′ E.
Chinfimo, 5° 20′ S., 12° 15′ E.
Coquilhatville, 0° 1′ N., 18° 20′ E.
Delarey, 26° 40′ S., 25° 30′ E.
Elisabethville, 11° 45′ S., 27° 40′ E.
Faradje, 3° 40′ N., 29° 40′ E.
Garamba, 4° 10′ N., 29° 40′ E.
Johann-Albrechtshöhe, 4° 40′ N., 9° 25′ E.
Kampala, 0° 20′ N., 32° 20′ E.
Kasala (R.), near Mpumu.
Kasenga, 10° 15′ S., 28° 45′ E.
Kiadondo, near Kampala.
Kikwit, 5° 25′ S., 18° 50′ E.
Kimuenza, 4° 25′ S., 15° 20′ E.
Kinshasa, 4° 20′ S., 15° 20′ E.
Landana, 5° 15′ S., 12° 15′ E.
Lastourville, 0° 45′ S., 12° 40′ E.
Leopoldville, 4° 25′ S., 15° 20′ E.
Lisala, 2° 10′ N., 21° 30′ E.
Lokoja, 7° 35′ N., 6° 30′ E.
Lolodorf, 3° 15′ N., 10° 40′ E.
Lubumbashi, 11° 45′ S., 27° 40′ E.
Lubutu, 0° 40′ S., 26° 40′ E.
Lukolela, 1° 10′ S., 17° 10′ E.
Lutete, 5° S., 14° 40′ E.
Mabira Forest, 0° 30′ N., 32° 45′ E.
Malela, 6° S., 12° 40′ E.
Masindi, 1° 50′ N., 31° 50′ E.
Matadi, 5° 50′ S., 13° 35′ E.
Medje, 2° 25′ N., 27° 30′ E.
Misahöhe, 6° 55′ N., 0° 35′ E.
Mpumu, 0° 15′ N., 32° 50′ E.
Murchison Falls, 2° 15′ N., 31° 40′ E.
Niangara, 3° 40′ N., 27° 50′ E.
Niapu, 2° 15′ N., 26° 50′ E.
Nimule, 3° 40′ N., 32° 10′ E.
Ntem (R.), 2° 10′ N., 12° E.
Ogowe (R.), 1° S., 10° E.
Oware, 5° 30′ N., 7° E.
Panga, 1° 45′ N., 26° 15′ E.
Pawa, 2° 25′ N., 27° 50′ E.
Poko, 3° 10′ N., 26° 50′ E.
Port Natal, 29° 50′ S., 31° E.
Rio Nunez, 10° 45′ N., 14° 35′ W.
Ruwe, 10° 40′ S., 25° 35′ E.
Sanaga (R.), 3° 30′ to 4° N., about 10° E.
San Benito (R.), 1° 35′ N., 9° 35′ E.
Sanga (Mayumbe).
Sangha (R.), 5° N. to 1° S., 16° to 17° E.
Sibange Farm, 0° 25′ N., 9° 35′ E.
Stanleyville, 0° 30′ N., 25° 15′ E.
Thysville, 5° 30′ S., 15° E.
Tshumburi [=Chumbiri], 2° 40′ S., 16° 15′ E.
Usoga [=Busoga], 0° 30′ N., 33° 30′ E.
Vankerckhovenville, 3° 20′ N., 29° 20′ E.
Vivi, 5° 45′ S., 13° 35′ E.
Wadelai, 2° 45′ N., 31° 30′ E.
Wathen, 5° S., 14° 35′ E.
Zambi, 6° S., 12° 50′ E.

PANGONIINÆ

TRIBE Pangoniini

Dasycompsa cincta Enderlein

Dasycompsa cincta ENDERLEIN, 1922, Mitt. Zool. Mus. Berlin, X, pt. 2, p. 344 (without specific description); 1925, *op. cit.*, XI, pt. 2, p. 317 (♂; Sanaga, Cameroon). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 871 (♀ ♂).

BELGIAN CONGO.—Stanleyville, three females and two males (one of them the allotype), as prey of *Bembix bequaerti* var. *dira* Arnold, April, 1915 (H. Lang and J. P. Chapin).

Tabanocella stimulans (Austen)

Rhinomyza stimulans AUSTEN, 1910, Ann. Mag. Nat. Hist., (8) VI, p. 354 (♀; Benué River, between Bagana anad Lokoja, Northern Nigeria).

Tabanocella stimulans J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 874.

BELGIAN CONGO.—Niangara, one female, June, 1913; Medje, three females; Stanleyville, seven females and one male, as prey of *Bembix bequaerti* var. *dira* Arnold, March and April, 1915 (H. Lang and J. P. Chapin).

The American Museum possesses also a female of this species from the Gaboon.

Tabanocella perpulcra (Austen)

Rhinomyza perpulcra AUSTEN, 1910, Ann. Mag. Nat. Hist., (8) VI, p. 349 (♀; Kasala Stream near Mpumu, Uganda).

Tabanocella perpulcra J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 876.

BELGIAN CONGO.—Medje, one female (H. Lang and J. P. Chapin).

This specimen agrees in every detail with Austen's excellent description, so that there is no longer any doubt as to the occurrence of this species in the Belgian Congo. The description of the abdominal markings in my key (1930, *op. cit.*, p. 873) should be corrected to read: "Abdomen yellow to brownish yellow, with two dorsal, longitudinal, brownish-black bands, which are narrowed and removed from the sides of the first and most of the second tergite." On the remainder of the abdomen the black bands reach the sides and they are fused over the apical tergite.

Thriambeutes singularis Grünberg

Thriambeutes singularis GRÜNBERG, 1906, Zoolog. Anzeiger, XXX, p. 354, Figs. 4–6 (♀; Misahöhe, Togo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 877. SCHOUTEDEN, 1927, Rev. Zool. Afric., XV, pt. 2, Bull. C. Zool. Cong., p. [10]; 1931, Rev. Zool. Bot. Afric., XX, pt. 4, Bull. C. Zool. Cong., p. [98].

BELGIAN CONGO.—Stanleyville, one female and one male, March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

Schouteden has also reported this tabanid from Basongo and Sanga (Mayumbe), localities of the Belgian Congo not listed by me in 1930.

Thriambeutes austeni (Hine)

Orgizomyia austeni HINE, 1927, Amer. Mus. Novitates, No. 285, p. 3 (♀ ♂; Stanleyville, Belgian Congo).

Thriambeutes austeni J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 876. SCHOUTEDEN, 1931, Rev. Zool. Bot. Afric., XX, pt. 4, Bull. C. Zool. Cong., p. [98]; 1932, *op. cit.*, XXI, Bull. C. Zool. Cong., p. [37].

BELGIAN CONGO.—Stanleyville, thirty-nine females and thirty-three males (including the holotype ♀ and the allotype ♂), March, April, and May, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin). One of the males was freshly hatched and not yet colored out.

Schouteden recently reported this species from Bayenga (Uele-Nepoko), and from Faradje.

Subpangonia gravoti Surcouf

Subpangonia gravoti SURCOUF, 1908, Bull. Mus. Hist. Nat. Paris, XIV, p. 284 (♀; N'tem Basin, French Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 880 (♀ ♂).

BELGIAN CONGO.—Stanleyville, four males, March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

TRIBE **Chrysopini**

Chrysops griseicollis J. Bequaert

Chrysops griseicollis J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 897 (♀; Stanleyville, Belgian Congo).

BELGIAN CONGO.—The holotype was collected at Stanleyville by H. Lang and J. P. Chapin, as prey of *Bembix bequaerti* var. *dira* Arnold. Another, poorly preserved female (not a type) bears the same data; it was sent for examination to Major Austen, who recognized in it a new species.

Chrysops dimidiata van der Wulp

Chrysops dimidiata VAN DER WULP, 1885, Notes Leyden Mus., VII, p. 80[1] (♀; Chinfimo near Landana, Portuguese Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 897.

---

[1]The page reference given by me in 1930 is erroneous.

BELGIAN CONGO.—Stanleyville, four females, March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold; Medje, one female (H. Lang and J. P. Chapin).

Chrysops silacea Austen

Chrysops silacea AUSTEN, 1907, Ann. Mag. Nat. Hist, (7) XX, p. 509 (♀; Kimuenza, Belgian Congo, one of the original localities, designated as type locality by J. Bequaert in 1930). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 898.

BELGIAN CONGO—Medje, six females; Akenge, four females, October, 1913 (H. Lang and J. P. Chapin).

Chrysops langi J. Bequaert

Chrysops langi J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 898 (♀ ♂; Stanleyville, Belgian Congo).

BELGIAN CONGO.—The holotype (♀), allotype (♂) and four paratypes (♀) were collected at Stanleyville by H. Lang and J. P. Chapin, as prey of *Bembix bequaerti* var. *dira* Arnold.

Major Austen, to whom a paratype was sent for examination, recognized in it a new species allied to *C. dimidiata* van der Wulp.

Chrysops distinctipennis Austen

Chrysops distinctipennis AUSTEN, 1906, 'Second Rept. Wellcome Res. Labor. Khartoum,' p. 53, Pl. IV (♀; Usoga, Uganda). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 900.

BELGIAN CONGO.—Faradje, one female, April, 1911 (H. Lang and J. P. Chapin).

This specimen was sent to Major Austen, who kindly confirmed the identification.

Chrysops longicornis Macquart

Chrysops longicornis MACQUART, 1838, Mém. Soc. Sci. Agric. Arts Lille, pt. 2, p. 160, Pl. XIX, figs. 2–2*a*; 1838, 'Dipt Exot.,' I, pt. 1, p. 156, Pl. XIX, figs. 2–2*a* (♀; Senegal). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 901.

BELGIAN CONGO.—Malela, five females, June, 1915 (H. Lang and J. P. Chapin).

TABANINÆ

TRIBE **Tabanini**

Tabanus irroratus Surcouf

Tabanus irroratus SURCOUF, 1909, Bull. Mus. Hist. Nat. Paris, XV, p. 355 (♀; Lastourville, French Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 914.

BELGIAN CONGO.—Stanleyville, seven females, March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

Tabanus fasciatus Fabricius

Tabanus fasciatus FABRICIUS, 1775, 'Syst. Entom.,' p. 788 (no sex; Sierra Leone; according to Wiedemann, Fabricius' type was a ♀). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 914.

Tabanus fasciatus var. *nigripes* SURCOUF, 1909, Bull. Mus. Hist. Nat. Paris, XV, p. 537 (no sex; no locality mentioned, but by inference from the Belgian Congo). Not *Tabanus nigripes* Wiedemann, 1821.

BELGIAN CONGO.—Lisala, May 16, 1915; Coquilhatville, thirteen females, May 19, 1915; between Bolobo and Lukolela, four females; Medje; Stanleyville, March, 1915, twenty females, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin). Lukolela, eighteen females, October 1930 to April 1931 (J. P. Chapin).

The variations of this common, West African species have been recently discussed by me (1930). Unfortunately several matters were overlooked at the time. The name "*nigripes*" is preoccupied in the genus *Tabanus* by Wiedemann's earlier use of it for a North American species. However, no new vocable will be needed for Surcouf's var. *nigripes*, since a more careful study of the original descriptions shows that Fabricius' *fasciatus* and Surcouf's *nigripes* were both based upon the very same color form. In his original account, Fabricius wrote: "*Pedes nigri, femoribus pallidis.*" No Sierra Leone specimens are available; but I have seen several females from Liberia, in which all the tibiæ and tarsi are entirely black, the hair fringes of the hind tibiæ being also pure black. Surcouf's variety *nigripes* was briefly described as having all the "tibiæ and tarsi black."

Surcouf (1909, Bull. Mus. Hist. Nat. Paris, XV, p. 537) regarded as typical *fasciatus* a form of the species with "the fore tibiæ black with black pile, the other tibiæ yellowish." Such specimens are occasionally found in the Belgian Congo; but I do not believe that they are more than individual variations and as such deserve no special name. Not only are they taken in the same localities, together with the typical form, but they are also connected with the latter by transitional specimens in which the middle and hind tibiæ show various degrees of infuscation. It may be noted here that in most specimens of *T. fasciatus* that I have seen, from Liberia as well as from the Belgian Congo, the fore femora also are considerably darkened.

Tabanus atripes van der Wulp (1885, Notes Leyden Mus., VII, p. 75, Pl. v, fig. 4), based upon a female from the Ogowe River, Gaboon,

was described as having the "legs black; anterior tibiæ slightly dilated, convex on the outside; hind tibiæ fringed on both sides with short black hairs." Assuming this description to be correct, it would seem that specimens agreeing with it have not been seen again. Those from various localities in the Gaboon, called *T. atripes* by Surcouf (1909, 'Et. Monogr. Taban. Afrique,' p. 24), are very different, since he states that the inner and outer fringes of the hind tibiæ ("cuisses postérieures" is evidently a *lapsus* for "tibias postérieurs") are "d'un jaune doré." These specimens, if they have actually the legs entirely black, must represent a quite remarkable color variety; but, not having seen them, I refrain from proposing a name.[1]

Tabanus fasciatus subspecies *niloticus* Austen (1906, 'Second Rept. Wellcome Res. Labor. Khartoum,' p. 62, Pl. VI; ♀; Anglo-Egyptian Sudan) was excellently described and illustrated by the author. It differs from the typical form, "in the colouration and hairy covering of the front tibiæ (which in the typical form are entirely black and clothed exclusively with black hair), in the colouration of the middle and hind tibiæ (yellow or greenish yellow instead of black or dark brown), and in the hind tibiæ on the outside having a golden instead of a black fringe." Although (as recognized by Austen) this race is connected by transitions with typical *T. fasciatus*, it is fully entitled to recognition by name. It is, moreover, chiefly a Sudanese form, being known from Gambia, Dahomey, Northern Nigeria, French Equatorial Africa, the Anglo-Egyptian Sudan, Uganda, and the Nyanza Province of Kenya Colony.

In his account of the subspecies *niloticus*, Austen mentions that "A transitional form [to typical *T. fasciatus*] is also found in the Congo Free State, where specimens are met with showing no golden hairs on the basal half of the front tibiæ, but with golden hairs, interspersed with the black or more or less predominant, in the fringe on the inner and outer side of the basal half of the hind tibiæ." Surcouf's var. *mixtus* (May 1914, Rev. Zool. Afric., III, pt. 3, p. 472)[2] was evidently based upon such specimens from the Belgian Congo (Bolobo; Yumbi, Morebu Moke; Lukolela; Bamu; between Irebu and Ikengo; all these localities are on the River Congo, between Kinshasa and Coquilhatville). Surcouf even mentions specimens from Yumbi and Bolobo having the fringe of the hind tibiæ "complètement dorée." Since every transition may be found in the very same locality from specimens with a black fringe to those with the fringe almost entirely golden, I believe that the latter are only extreme individual variations, not worthy of recognition in nomenclature.

[1]Surcouf's plate I, fig. 1, labelled "*Tabanus atripes*," represents a specimen without legs.
[2]*Tabanus mutus* Szilády, of the Mediterranean Subregion, was published in December, (1914 Ann. Mus. Nat. Hungarici, XII, p. 672).

My key (1930) to the varieties of *T. fasciatus* should be amended as follows:

1.—Ground color of all legs entirely black . . . . 2.
Legs partly greenish yellow . . . . 3.
2.—Fringes of hind tibiæ black . . . . var. *atripes* (van der Wulp).
Fringes of hind tibiæ golden (? Surcouf's supposed "*atripes*" from the Gaboon).
3.—Fore tibiæ dark brown, yellowish toward base above, where they bear short, golden hair; middle and hind tibiæ yellow or greenish yellow; hind tibiæ with the outer fringe entirely golden, the inner fringe partly yellow and partly black . . . . subsp. *niloticus* Austen.
Fore tibiæ entirely black, clothed with black hair only; middle and hind tibiæ varying from yellowish brown to pure black . . . . 4.
4.—Outer fringe of hind tibiæ black . . . . typical *fasciatus*.
Outer fringe of hind tibiæ partly or wholly golden . . . var. *mixtus* Surcouf.

Although *T. fasciatus* is one of the most common West African species of the genus, males are hardly ever seen in collections and that sex has never been properly described. There are only two references to it in the literature. Wiedemann (1828, 'Aussereurop. Zweifl. Ins.,' II, p. 134) follows his brief diagnosis of *T. fasciatus* with the signs "♂ ♀"; but he evidently did not see a male from Sierra Leone (as Surcouf states). His more detailed description of the male of the Vienna Museum could not have been based upon an African *T. fasciatus*. The statement that each segment of the abdomen showed a triangular whitish spot suggests that he had before him the male of the species from Java (probably *Tabanus optatus* Walker), which he described in a preceding paragraph as differing in a number of particulars from the African *T. fasciatus*.

In a key to the species of his "First Group" of *Tabanus*, Surcouf (1922, 'Voy. de M. de Rothschild en Ethiopie, Rés. Scientif., Anim. Artic.,' II, p. 843) states that in the male of *T. fasciatus* subspecies *niloticus*, the eyes have a zone of large facets of a grayish-bronze color, the remainder being as in the female. The locality of this male is not given.

Tabanus boueti Surcouf

Tabanus boueti SURCOUF, 1907, Bull. Mus. Hist. Nat. Paris, XIII, p. 333 (♀; Lower Ivory Coast). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 919 (♀ ♂).

BELGIAN CONGO.—Stanleyville, six females and four males (including the ♂ allotype), March, 1915, as prey of *Bembix bequaerti* Arnold var. *dira* Arnold (H. Lang and J. P. Chapin).

One of the females sent for study to Major Austen was named by him *T. boueti*.

Tabanus besti Surcouf

Tabanus besti Surcouf, 1907, Archives de Parasitologie, XI, p. 473 (♀; Gambia). J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 919 (♀ ♂).

Belgian Congo.—Stanleyville, five females and five males (including the ♂ allotype), March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

Some of the females were sent for study to Major Austen, who identified them as *T. besti*.

Tabanus obscurehirtus Ricardo

Tabanus obscurehirtus Ricardo, 1908, Ann. Mag. Nat. Hist., (8) I, p. 374 (♀; Lutete, Belgian Congo). J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 920 (♀ ♂).

Belgian Congo.—Stanleyville, one female and one male (allotype), March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold; Akenge, two females, October, 1913; between Bolobo and Lukolela, nine females, July, 1909 (H. Lang and J. P. Chapin). Lukolela, one female, April, 1931 (J. P. Chapin).

Tabanus par Walker

Tabanus par Walker, 1854, 'List Dipt. Brit. Mus.,' V, Suppl. 1, p. 235 (♀; Port Natal). J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 921.

Belgian Congo.—Zambi, one female, June, 1915 (H. Lang and J. P. Chapin).

Tabanus thoracinus Palisot de Beauvois

Tabanus thoracinus Palisot de Beauvois, 1807,[1] 'Insectes Recueillis en Afrique et Amérique,' p. 55 (♀; Oware and Benin, Southern Nigeria); Atlas, Pl. i (Dipt.), fig. 4. J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 922.

Belgian Congo.—Stanleyville, four females (H. Lang and J. P. Chapin). Lukolela, one female, April, 1931 (J. P. Chapin).

Tabanus obscurior Ricardo

Tabanus obscurior Ricardo, 1908, Ann. Mag. Nat. Hist., (8) I, p. 276 (♀; Wathen, Belgian Congo). J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 922.

Belgian Congo.—Stanleyville, five females and eleven males (including the allotype), March and April, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

[1]According to C. D. Sherborn (1922, 'Index Animalium,' Sect. 2, pt. 1, p. xcix), pp. 41 to 80 of Palisot de Beauvois' work, containing the descriptions of the African species, *T. thoracinus*, *T. ruficrus*, and *T. taeniola*, were published in 1807.

Tabanus fuscomarginatus Ricardo

Tabanus fuscomarginatus RICARDO, 1908, Ann. Mag. Nat. Hist., (8) I, p. 273 (♀; Kampala-Kiadondo, Uganda). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 923.

BELGIAN CONGO.—Avakubi, six females, October, 1909; Panga, five females, September, 1914; Akenge, one female, October, 1913 (H. Lang and J. P. Chapin).

Tabanus ruficrus Palisot de Beauvois

Tabanus ruficrus PALISOT DE BEAUVOIS, 1807, 'Insectes Recueillis en Afrique et Amérique,' p. 55 (♀; Oware, Southern Nigeria); Atlas, Pl. I (Dipt.), fig. 3 (as *T. rufipes*). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 923.

BELGIAN CONGO.—Stanleyville, three females, August 25, 1909; Bafwaboli, three females, September, 1909; between Bolobo and Lukolela, one female, July, 1909; Medje, four females; Pawa, one female; Garamba, two females, February, 1910 (H. Lang and J. P. Chapin). Lukolela, six females, December, 1930, and January, 1931 (J. P. Chapin).

The American Museum collection contains also three females from the Gaboon.

Tabanus canus Karsch

Tabanus canus KARSCH, 1879, Zeitschr. Ges. Naturw., LII, p. 377, Pl. IV, fig. 1 (♀; Chinchoxo, Portuguese Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 924 (♀ ♂).

BELGIAN CONGO.—Medje, two females, August 25, 1910; Avakubi, one female, October 13, 1909; Poko, one female, August, 1913; Stanleyville, two females and one male (allotype), March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin). Lukolela, one female, November 6, 1930 (J. P. Chapin).

Tabanus billingtoni Newstead

Tabanus billingtoni NEWSTEAD, 1907, Ann. Trop. Med. Paras., I, p. 46, Pl. III, fig. 1 and Pl. IV, figs. 10–12 (♀ ♂; Tshumbiri, Bolengi and Matadi, Belgian Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 925.

BELGIAN CONGO.—Niapu, one female, January, 1914; Akenge, two females, September, 1913; between Bolobo and Lukolela, one female, July, 1909; Basoko, one female, July 25, 1909; Stanleyville, seven females and two males, April, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin). Lukolela, three females, November 1, 1930, and April, 1931 (J. P. Chapin).

Tabanus marmorosus var. **congoicola** J. Bequaert

Tabanus marmorosus var. *congoicola* J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 926 (♀ ♂; holotype ♀, between Thysville and Kinshasa; allotype ♂, Stanleyville; paratypes ♀, Stanleyville and Lubutu; all Belgian Congo).

Belgian Congo.—Stanleyville, two females; (paratypes) and one male (allotype), April, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold; Medje, one female (H. Lang and J. P. Chapin).

A female from the Gaboon, in the American Museum Collection, also belongs to the variety *congoicola*.

Tabanus obscurefumatus Surcouf

Tabanus obscurefumatus Surcouf, 1906, Bull. Mus. Hist. Nat. Paris, XII, p. 523 (♀; San Benito River, French Congo). J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 927 (♀ ♂).

Belgian Congo.—Medje, one female, Stanleyville; two males (one the allotype), March and April, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

Tabanus brunneicollis Hine and Bequaert, new species

Female.—Length of body (two specimens), 18 mm.; width of head, 6 mm.; length of wing, 15 to 16 mm.; width of frons, nearly three-fourths mm. at vertex, not more than one-half mm. at lower margin of the eye.

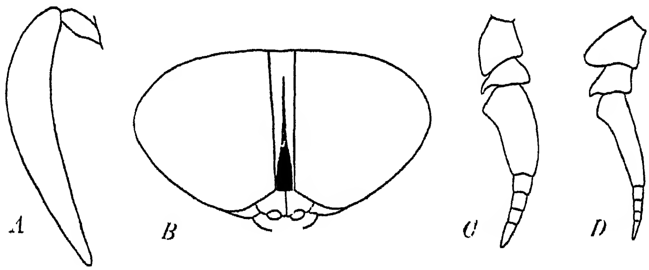


Fig. 1. *Tabanus brunneicollis*, new species. *A*, palp of female; *B*, head of female from above; *C*, antenna of female; *D*, antenna of male.

A brown, rather robust species. Abdomen black with white hairs on the posterior margins of the segments, especially prominent on the margins of segments two, three and four. Wings nearly uniformly dark brown, in both sexes. Legs dark brown. Eyes bare. All the posterior cells open; fork of third longitudinal vein without appendix.

Head: frons and face uniformly brown pollinose; face with sparse black hairs; beard black; frons near three-fourths millimeter wide at vertex, gradually narrowed

to the lower margin of the eyes; frontal callosity (Fig. 1*B*) almost as wide as the frons below, of the same width for nearly the first millimeter of its length, then quite rapidly narrowed to a line that extends upward to the last quarter of the frons. Antennæ, palpi, and proboscis of the same color, very dark brown, nearly black, and furnished with black hair; first antennal segment enlarged and most prominent dorsally; third segment (Fig. 1*C*) in general rather narrow, dorsal basal prominence conical, not pronounced and very close to the base of its segment, basal portion decidedly longer than the annulate portion. Palpi (Fig. 1*A*) slender, as long as the proboscis. Thorax: dorsum, including the scutellum, reddish brown without evident markings, clothed mostly with short pale brownish hair; sides clothed with longer and darker hair; a small tuft of black hairs beneath the base of the wing and another one in front of the halter on the pleuron. Abdomen: dorsally, first segment brown, just a little darker than the scutellum, clothed mostly with dark hair, but a few white hairs at middle and sides of posterior margin; remainder of abdomen black; immediate posterior margins of segments two, three, and four, each with a fringe of hairs, conspicuously silvery white at sides and in the middle and dark otherwise; segments beyond the fourth not white fringed on the margins, except for a few white hairs in the middle and on the sides of the fifth. Ventrally, the abdominal colors agree with the dorsum, except that the fringes of white hairs are interrupted by dark ones at the middle, thus forming two series instead of three. Squamæ brown and bearing a tuft of white hairs. Halteres with brown stalks and pale yellowish-white knobs. Legs dark brown; fore femora nearly black, clothed everywhere with dark hairs; fore tibiæ not dilated.

MALE.—Length of body (four specimens), 17 to 19 mm.; width of head, 6 to 7.5 mm.

Head somewhat enlarged; a very large area of enlarged facets which are abruptly separated from small facets above and below. Abdomen reddish brown above and below, with pale yellowish hairs on the posterior margins of the segments. Otherwise the male is colored like the female and is easily associated with it. Third antennal segment (Fig. 1*D*) much more slender than in the female.

BELGIAN CONGO.—Holotype female and a paratype of the same sex; allotype and three paratype males; all from Stanleyville, March, 1915, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

Holotype and allotype at The American Museum of Natural History. Paratypes (♀ ♂) at the Museum of Comparative Zoology, Cambridge, Mass.

This species has affinities with *T. obscurefumatus* Surcouf, but the color of legs and wings are distinctive and it is more robust in general appearance. *T. tenuipes* Austen, from the Gold Coast and Sierra Leone, suggests *brunneicollis*, but that species has a distinct white scutellum, the frons is described as being narrower and the legs as being very differently colored.

Tabanus biguttatus Wiedemann

Tabanus biguttatus WIEDEMANN, 1830, 'Aussereurop. Zweifl. Ins.,' II, p. 623 (♂; Cape of Good Hope). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 928 (♀ ♂).

BELGIAN CONGO.—Matadi, one male, June 9, 1915 (H. Lang and J. P. Chapin).

Tabanus xanthomelas Austen

Tabanus xanthomelas AUSTEN, 1912, Ann. Mag. Nat. Hist., (8) IX, p. 29 (new name for *T. leucaspis* van der Wulp). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 930 (♀ ♂).

BELGIAN CONGO.—Garamba, five females, June, 1912; Faradje, five females, March, 1911; Vankerckhovenville, two females, April, 1912 (H. Lang and J. P. Chapin).

Tabanus variabilis Loew

Tabanus variabilis LOEW, 1858, Öfv. Kgl. Vet. Ak. Förh., Stockholm, XIV (1857), p. 340 (♀; Caffraria). J. BEQUAERT, 1930, 'The African Republic of Liberia a d the Belgian Congo,' II, p. 934.

BELGIAN CONGO.—Stanleyville, one female, as prey of *Bembix bequaerti* var. *dira* Arnold (H. Lang and J. P. Chapin).

Tabanus laverani Surcouf

Tabanus laverani SURCOUF, 1907, Bull. Mus. Hist. Nat. Paris, XIII, p. 331 (♀; lower Rio Nunez, French Guinea). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 935.

BELGIAN CONGO.—Garamba, one female, May 3, 1912 (H. Lang and J. P. Chapin).

Tabanus socialis Walker

Tabanus socialis WALKER, 1850, 'Ins. Saunders.,' I, Dipt., p. 45 (♀ "Cape," according to Austen, the type is labelled "Congo"). J. BEQUAERT 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 937.

BELGIAN CONGO.—Stanleyville, three females and four males (one the allotype), as prey of *Bembix bequaerti* var. *dira* Arnold, March, 1915 (H. Lang and J. P. Chapin).

MALE (undescribed).—Length of body, 15 mm.; width of head, 5.8 mm.; length of wing, 12 mm.

Very similar to the female, with which it is readily associated; the lighter median markings of the dorsum of the abdomen very indistinct. Head large, hemispherical, with holoptic eyes; area of enlarged facets sharply delimited, occupying most of the upper two-thirds of the eye, though separated from the posterior orbit by a wide band of small facets; in the dry specimen a broad pale band divides the two areas. Third antennal segment more slender than in the female, with the basal tooth lower.

Four specimens from Stanleyville. Allotype at The American Museum of Natural History.

One of the females was identified by Major Austen.

Tabanus secedens Walker

Tabanus secedens WALKER, 1854, 'List Dipt. Brit. Mus..' V, Suppl. 1, p. 224 (new name for *T. tibialis* Walker). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 938 (♀ ♂).

BELGIAN CONGO.—Stanleyville, forty females and twenty-two males, as prey of *Bembix bequaerti* var. *dira* Arnold, March, 1915; Lisala, sixty-one females, May 16, 1915; Coquilhatville, forty-eight females, May 19, 1915; Basoko, five females, July 24, 1909; between Bolobo and Lukolela, seventeen females; Medje, two females; Avakubi, one female (H. Lang and J. P. Chapin).

I am more than ever inclined to regard *T. claripes* Ricardo, originally based upon a single female from Leopoldville, as an individual variation of *T. secedens*. Miss Ricardo stated that *claripes* is "easily distinguished by its bright reddish-yellow coxæ from *T. secedens* Wlk. . . . , and by its larger size and redder legs, the fore femora being red, not blackish and by the markings of the abdomen, which consist of distinct, grey, median, triangular spots, not continuous, and of indistinct reddish-yellow side spots. Length 24 mm." The description of the abdomen fits many of the specimens of *T. secedens* from the Belgian Congo, and in these the fore femora vary from red to blackish. The character of the "bright reddish-yellow coxæ" loses much of its value, through the more detailed description: "the coxæ at their extreme apex and the middle coxæ wholly black."

Tabanus quadrisignatus Ricardo

Tabanus quadrisignatus RICARDO, 1908, Ann. Mag. Nat. Hist., (8) I, p. 320 (♀; Ruwe, Katanga, Belgian Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 940.

BELGIAN CONGO.—Faradje, two females; Garamba, one female, May 3, 1912 (H. Lang and J. P. Chapin). Lukolela, eighteen females, August, 1930 (J. P. Chapin).

Tabanus congoiensis Ricardo

Tabanus congoiensis RICARDO, 1908, Ann. Mag. Nat. Hist., (8) I, p. 328 (♀; Wathen, Belgian Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 941 (♀ ♂).

BELGIAN CONGO.—Niangara, one female; Lisala, one female, May 15, 1915; Coquilhatville, one female, May 19, 1915; Stanleyville, seven females and two males (including the allotype), as prey of *Bembix bequaerti* var. *dira* Arnold, March, 1915 (H. Lang and J. P. Chapin).

Tabanus regnaulti Surcouf

Tabanus regnaulti SURCOUF, 1912, Bull. Soc. Ent. France, p. 183, Fig. 1 (on p. 184) (♀; Sangha River, French Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 942 (♀ ♂).

BELGIAN CONGO.—Stanleyville, seven females and four males (including the allotype), as prey of *Bembix bequaerti* var. *dira* Arnold, March, 1915 (H. Lang and J. P. Chapin).

One of the females was sent to Major Austen, who kindly confirmed the identification.

Tabanus sagittarius Macquart

Tabanus sagittarius MACQUART, 1838, Mém. Soc. Sci. Agric. Arts Lille, pt. 2, p. 127; 1838, 'Dipt. Exot.,' I, pt. 1, p. 123 (♀; Cape of Good Hope). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 943.

BELGIAN CONGO.—Faradje, one female; between Bolobo and Lukolela, three females, July, 1909 (H. Lang and J. P. Chapin).

Tabanus tæniola Palisot de Beauvois

Tabanus tæniola PALISOT DE BEAUVOIS, 1807, 'Insectes Recueillis en Afrique et Amérique,' p. 56 (♀; Oware and Benin, Southern Nigeria); Atlas, Pl. I (Dipt.), fig. 6. J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 943.

BELGIAN CONGO.—Lisala, six females, May 16, 1915; Coquilhatville, five females, May 19, 1915; between Bolobo and Lukolela, one female, July, 1909; Faradje, three females; Garamba, one female (H. Lang and J. P. Chapin). Lukolela, two females, August, 1930 (J. P. Chapin).

Tabanus denshamii Austen

Tabanus denshamii AUSTEN, 1908, Ann. Mag. Nat. Hist., (8) I, p. 222 (♀; between Masindi and Murchison Falls, Uganda). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 944.

BELGIAN CONGO.—Faradje, two females, April, 1911 (H. Lang and J. P. Chapin).

Thaumastocera akwa Grünberg

Thaumastocera akwa GRÜNBERG, 1906, Zoolog. Anzeiger, XXX, p. 356, Figs. 7, 8 and 9 (♀ ♂; Johann-Albrechtshöhe and Lolodorf, Cameroon). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 946 (♀ ♂).

BELGIAN CONGO.—Stanleyville, one female and one male, as prey of *Bembix bequaerti* var. *dira* Arnold, March, 1915 (H. Lang and J. P. Chapin).

I have also seen recently a female from the Mabira Forest, in eastern Uganda (collected by Mr. Arthur Loveridge, August 1, 1930), which is as far east as this species has ever been found. It is one more proof, if any were needed, that the fauna of Uganda is typically West African or Guinean.

Tribe **Hæmatopotini**

Hæmatopota ciliatipes J. Bequaert

Hæmatopota ciliatipes J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 956 (♀; Kikwit, the type locality, and several other localities in the Belgian Congo).

Belgian Congo.—Avakubi, one female paratype, October 4, 1909 (H. Lang and J. P. Chapin).

Hæmatopota denshamii Austen

Hæmatopota denshamii Austen, 1908, Ann. Mag. Nat. Hist., (8) I, p. 220 (♀; Nimule to Wadelai, Uganda). J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 958 (♀ ♂).

Belgian Congo.—Garamba, fifty-two females, June, 1912; Faradje, four females, April, 1911; Pawa, one female, April 7, 1913 (H. Lang and J. P. Chapin).

Some of these specimens were sent to Major Austen, who kindly confirmed the identification.

Hæmatopota inornata Austen

Hæmatopota inornata Austen, Ann. Mag. Nat. Hist., (8) II, p. 103 (♀; Buddu, Uganda). J Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 960.

Belgian Congo.—Medje, four females (H. Lang and J. P. Chapin).

Hæmatopota partifascia J. Bequaert

Hæmatopota partifascia J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 962 (♀; Lubutu, Belgian Congo).

Belgian Congo.—Lukolela, one female, November 19, 1930 (J. P. Chapin).

Hæmatopota ochracea (Bezzi)

Chrysozona Hæmatopota) ochracea Bezzi, 1908, Ann. Soc. Ent. Belgique, LII, p. 375 (♀; Vivi, Belgian Congo).

Hæmatopota ochracea J. Bequaert, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 964 (♀ ♂).

Belgian Congo.—Zambi, one female, June, 1915; Malela, fourteen females and one male (allotype), June, 1915 (H. Lang and J. P. Chapin).

Hæmatopota angustifrons Carter

Hæmatopota angustifrons CARTER, 1915, Ann. Trop. Med. Paras., IX, p. 185, Fig. 6; Pl. XIII, fig. 2 (♀; Belgian Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 967.

BELGIAN CONGO.—Lukolela, one female, July 30, 1930 (J. P. Chapin).

Hæmatopota harpax Austen

Hæmatopota harpax AUSTEN, 1914, Bull. Ent. Res., IV, p. 289 (♀; Coquilhatville, Belgian Congo). J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 968.

BELGIAN CONGO.—Bumba, two females, May 15, 1915 (H. Lang and J. P. Chapin). Lukolela, one female, December 24, 1930 (J. P. Chapin).

Hippocentrum strigipenne (Karsch)

Hæmatopota strigipennis KARSCH, 1889, Entom. Nachrichten, XV, p. 240 (♀; Sibange Farm, Gaboon River, French Congo).

Hippocentrum strigipenne J. BEQUAERT, 1930, 'The African Republic of Liberia and the Belgian Congo,' II, p. 970 (♀ ♂).

BELGIAN CONGO.—Stanleyville, eleven females and two males (including the allotype), as prey of *Bembix bequaerti* var. *dira* Arnold, March, 1915 (H. Lang and J. P. Chapin). Lukolela, six females, September to November, 1930 (J. P. Chapin).

AMERICAN MUSEUM NOVITATES

Number 540 — Published by The American Museum of Natural History, New York City — June 16, 1932

56.9 (1182: 78.2)

NEW FOSSIL MAMMALS FROM THE SNAKE CREEK QUARRIES[1]

By W. D. Matthew[2]

The collection made by Albert Thomson for the Museum in 1923 in Sioux County, Nebraska, includes considerable additions to the material from the Upper Snake Creek and Lower Sheep Creek beds (*Hipparion affine* zone, *Merychippus primus* zone). Some references to certain specimens were made in my last contribution to this fauna. A number of new or little known genera and species are described in the following pages.

Sthenictis bellus, new species

Type.—No. 20501, a right ramus of the lower jaw, with p_2-m_1 preserved.

Horizon and Locality.—Sheep Creek beds, Horizon A, Stonehouse draw quarry.

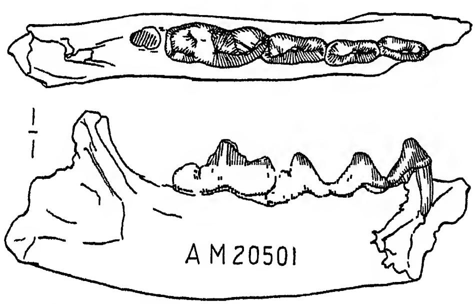


Fig. 1. *Sthenictis bellus*, sp. nov. Type, No. 20501. Lower jaws —outer and crown views, natural size.

Characters.—Size much less than *S. dolichops*, about equal to *Mionictis incerta* or *Brachypsalis matutinus*, but agrees with *Sthenictis* and differs from the other two in the construction and proportions of the carnassial and premolars. The second, third and fourth premolars are two-rooted, compressed, not crowded, p_4 with well developed posterior accessory cusp. The shear of the carnassial is nearly antero-posterior, the metaconid well developed but not nearly as high as in *Mionictis* or

[1]Snake Creek Contribution No. 4.

[2]The manuscript of this paper is one of several left at the American Museum by Dr. Matthew at the time of his death in September, 1930. It was apparently written about 1924, a year after the material was collected, and had been held awaiting illustrations. The section on *Archæohippus* was added subsequent to 1925. The paper is printed without additions or alteration.—Walter Granger.

Brachypsalis. The last molar has a single alveolus, which apparently contained a large anterior and smaller posterior root, closely connate. In *S. dolichops* the alveolus is round-oval apparently for a single root.

So far as the characters of the type jaw permit one to judge, this species is the ancestor in the *M. primus* zone of *S. dolichops* of the *M. paniensis* zone.

Cynarctus mustelinus, new species

TYPE.—No. 20502, lower jaw fragment with m_{1-2}. Paratype, No. 20503, lower jaw with p_{3-4} and m_{2-3}. Both from the Sheep Creek beds, *M. primus* zone, at Stonehouse draw quarry.

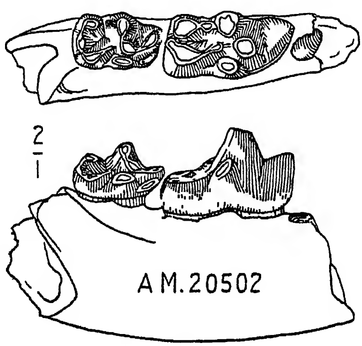


Fig. 2

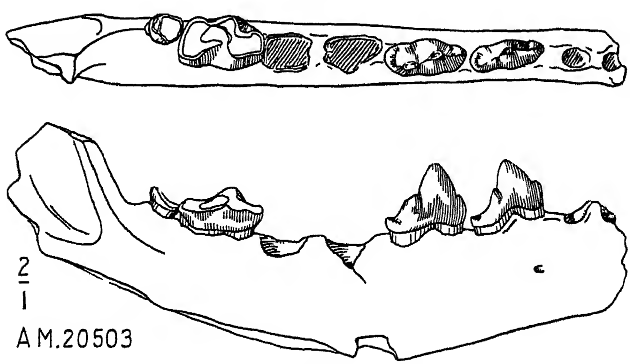


Fig. 3

Fig. 2. *Cynarctus mustelinus*, sp. nov. Type, No. 20502. Lower jaw—outer and crown views, twice natural size.

Fig. 3. *Cynarctus mustelinus*. Paratype, No. 20503. Lower jaw—outer and crown views, twice natural size.

Size much less than either *C. saxatilis* Matthew or *C. crucidens* Cook and more primitive than either species; the second molar two-thirds the length of m_1; in *C.*

saxatilis of the *M. paniensis* zone it is nearly three-fourths and in *C. crucidens* of the *Hipparion* zone it is approximately seven-eighths as long, the breadth increasing in about the same proportion. The last molar in *C. mustelinus* is very small, only a third the length of m_2; in *C. saxatilis* it is three-fifths as long, in *C. crucidens*, over two-thirds.

MEASUREMENTS IN MILLIMETERS

	C. mustelinus	*C. saxatilis*	*C. crucidens*
Length of m_1	8.5	16.1	10.5
" " m_2	5.7	11.6	9.2
" " m_3	2.0	7.0	6.3
Width of trigonid of m_1	3.7	6.7	4.5
" " heel of m_1	3.7	7.2	5.3

It will also be observed that the width of the carnassial talonid increases progressively, relative to the width of trigonid.

This species serves to indicate a probable derivation of *Cynarctus* from the *Nothocyon* group of the John Day and Lower Miocene formations, more particularly from *N. lemur* and *N. latidens*, rather than from the type species of *Nothocyon*, *N. geismarianus*. '*Cynarctus*' *acridens* Cook of the Upper Harrison beds, Lower Miocene, of Nebraska is intermediate in age and apparently in character, but so far as one can judge from the inadequate type, a jaw fragment with m_1, it is nearer to *Nothocyon* of the Lower Miocene than to *Cynarctus* of the Middle and Upper Miocene, and should be referred to the former genus, already known from skulls and parts of skeleta from the Lower Miocene of South Dakota as well as from the typical John Day skulls and skeletons. The adaptation and skull and skeletal characters of *Cynarctus* remain obscure; it parallels *Arctonyx* but can hardly be related.

Desmathyus validus, new species

TYPE.—No. 20506, upper jaw, young, with dp^3–m^1 and p^{3-4} preformed. Stonehouse draw quarry, *Merychippus primus* zone.

CHARACTERS.—Slightly larger than *D. pinensis*; p^3 sub-oval in form, nearly as large as p^4 and similar in cusp construction. In *D. pinensis* the inner crescent of p^3 is smaller and imperfect, giving the tooth a sub-trigonal outline.

This species is clearly a stage further advanced than its Lower Miocene predecessor *D. pinensis* of the Upper Rosebud, which in turn is a little more advanced than *D. siouxensis* of the Harrison. The third molar has completed its inner crescent and become entirely like the fourth. Like *Platygonus* and unlike the *Prosthennops-Dicotyles-Mylohyus* group, the premolars remain bicuspid and do not become progressively molariform. Possibly *D. validus* is an ancestral type for *Platygonus*, but the intermediate stages are unknown.

It may be observed in this connection that *Prosthennops* and *Mylohyus* are not ancestral to *Dicotyles*, and the very common assumption that the "peccaries" of the American Pleistocene indicate a warmer climate is based on the mistaken notion that they are extinct species of the existing tropical genus. This is true as to the tapirs but not as to the peccaries. Whether the climatic inference is warranted even with the tapirs may be open to question; the relationship is no closer in that case than between the tropical *Elephas indicus* and the arctic *E. primigenius*. But the Pleistocene peccaries, both *Platygonus* and *Mylohyus*,

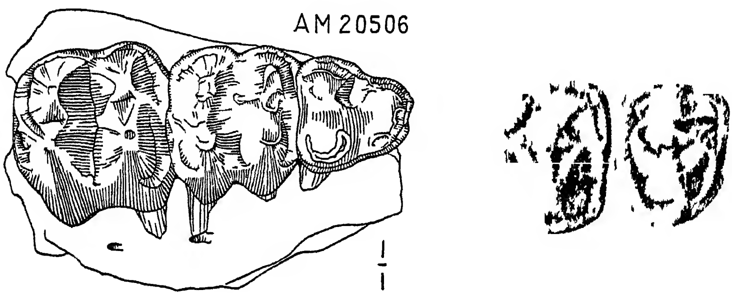
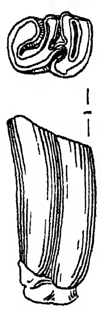


Fig 4

Fig. 4. *Desmathyus validus*, sp. nov. Type, No. 20506. Left, crown view of dp^{3}–^{4} and m^{1}. Right, crown view of unerupted p^{3}–^{4}. Both natural size.

are extinct genera decidedly more specialized in skull, teeth and feet than the modern peccaries, as well as larger in size. The relationship of *Mylohyus* to *Tagassu* is perhaps comparable to that between the woolly rhinoceros (*Cœlodonta antiquitatis*) and the modern white rhinoceros (*Ceratotherium simum*), while *Platygonus* is about as distant from the modern peccaries as *Elasmotherium* from the modern rhinoceroses.



AM20489

Fig. 5. *Castor* sp. No. 20489. Lower premolar—outer and crown views, natural size.

Castor sp.

A single lower tooth, p_4, A.M. 20489, from the Upper Snake Creek beds, agrees so nearly with the existing *Castor* that I am obliged to refer it to that genus. It is about the maximum of size for existing species and comes within the variation limits of dental structure, generic and individual, that I find in comparing with a series of modern jaws.

This is the first Tertiary record of true *Castor* in America, the Tertiary species formerly referred to it having been removed to other genera. It occurs in the Pliocene of Europe; according to Depéret, it first appears in the Pontian zone.

Gaillardia[1] **thomsoni**, new genus and species

TYPE.—No. 20508, a lower jaw, left ramus complete, with p_{3-4}, m_3 and alveoli of remaining teeth, from the Upper Snake Creek beds.

DIAGNOSIS.—Dentition probably $\overline{1\ 1.4.3}$. Jaw long, slender, proportioned as in *Talpa*, condyle knot-like, not transversely expanded, angular process a short flat transverse plate set at right angles to the plane of the jaw, coronoid process long,

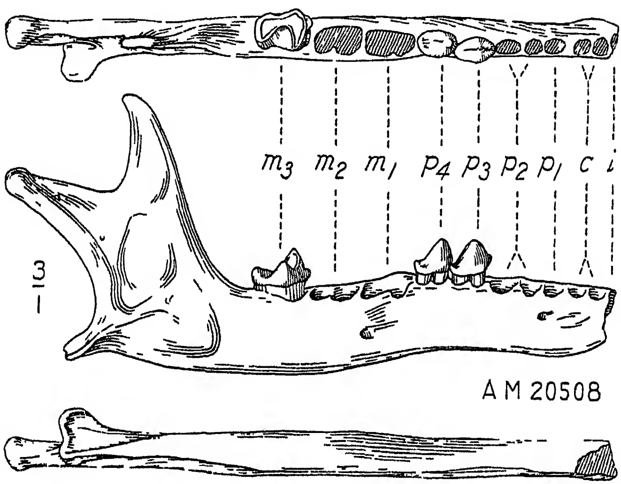


Fig. 6. *Gaillardia thomsoni*, gen. et sp. nov. Type, No. 20508. Lower jaw—outer, crown and under views, twice natural size.

projecting backward at 45° to line of teeth and but little recurved at tip, dentary portion of jaw long and slender, shallowed under premolars as in *Talpa*, posterior mental foramen under m_1. Tooth row continuous without diastemata, teeth neither spaced nor crowded. Las molar brachyodont, trituberculor, the trigonid shorter and wider than in *Talpa* or *Condylura*, the heel lower than trigonid and of about the same width. Third and fourth premolars of equal size, two-rooted, simple, robust, resembling those of *Myogale;* in front of these are two alveoli, probably for a p_2 longer than p_3 or p_4, then a single socket of sub-ovate outline, probably for p_1; in front of that is a double socket for a two-rooted canine; each of the two alveoli

[1]In honor of Claude Gaillard, distinguished palæontologist, who has contributed largely to our knowledge of Tertiary Insectivora. The species name is in honor of the discoverer, Albert Thomson of the Museum staff.

slightly larger than that of p_1; and at the anterior end, a single enlarged socket for a partly procumbent tooth.

I cannot place this jaw in any of the described genera of Talpidæ. It is distinguished from most of them by the reduction of the incisors to a single enlarged tooth; this also separates it from *Myogale* and *Galemys*, to which the premolars suggest relationship. The twinned alveoli behind this enlarged root cannot well be anything but a double-rooted canine. Were they for two incisors, the alveoli would be more separate at the alveolar border, for the dentition is evidently not crowded. They are also too closely connate to interpret the posterior one as the anterior root of a two-rooted first premolar (an improbable feature at best in this group). No other alternate can be suggested. From *Amphidozotherium* it is separated by the simple non-molariform p_4. It resembles *Condylura* in its slender proportions, more elongate than in *Talpa*, but the premolars are of different type, with robust and simple crowns, while *Condylura* has slender, sharp-pointed premolars with well developed heels and accessory cusps. *Scalops* and *Scapanus* have much shorter jaws with higher crowned molars. None of the Talpidæ have the peculiar construction of angle and coronoid seen in *Gaillardia; Condylura* perhaps comes nearest, but the angle in that genus is a long slender spine, extending backward and curving upward. No other Insectivora, Chiroptera or Menotyphla present these peculiar characters, so far as I have been able to make comparisons.

Procamelus near **robustus** Leidy

No. 20478, a lower jaw with part of skeleton associated, is from a pocket of somewhat uncertain horizon. It lay directly on top of the eroded surface of the Sheep Creek, at a level a little below the top of that formation, and lower than some other marginal specimens which certainly belong in the *paniensis* phase. It may, nevertheless, be a pocket of later age, let down to the lower level; as no other specimens were found with it, this cannot be verified. The species does not agree closely with any of the known Camelidæ, but is nearest to *P. robustus*, as represented by Leidy's type and various jaws in our collection, some of which are topotypes. It is a little smaller than *robustus:* the premolars are slightly less reduced. As compared with *Alticamelus leptocolon*, the teeth are of about the same size, but premolars 2 and 3 more reduced, m_3 more narrow and hypsodont. It differs from *Protolabis angustidens* in the larger relative size of the anterior molar and the premolars; from *P. heterodontus* also in the equal spacing of p_1 between c and p_2. These

are the nearest among the described species. *Protolabis* is separated, moreover, by the entirely different proportions of limbs and feet. *Alticamelus* is similarly separated, though by no means so clearly, by a disproportion in limbs and feet, in the opposite sense.

While the horizon of this specimen is uncertain, it is probably nearer to Lower than to Upper Snake Creek. It suggests that *Procamelus* is a derivative of *Alticamelus*, but that *Protolabis* is a distinct phylum.

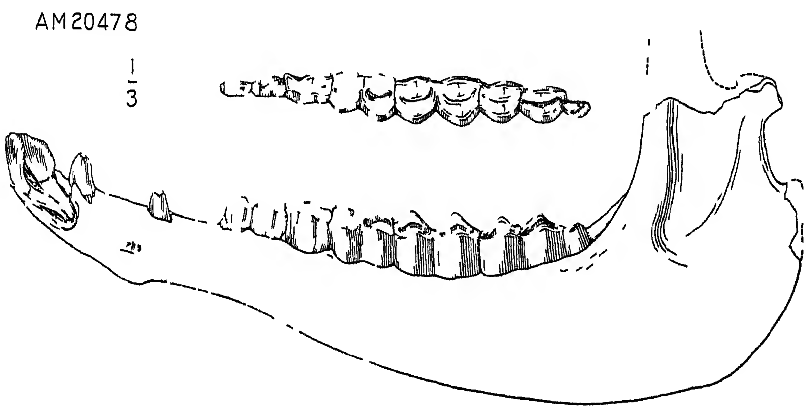


Fig. 7. *Procamelus* near *robustus*. No. 20478. Outer view of lower jaw and crown view of cheek teeth, one-third natural size.

Archæohippus penultimus

A number of immature palates and jaws, with some foot bones associated, Nos. 21532–35, were found together by Mr. Paul C. Miller in 1925, along with jaws of *Blastomeryx* and *Dyseomeryx*. The horizon is the Lower Sheep Creek beds in *Aphelops* draw, Snake Creek Quarries, Sioux County, Nebraska. No other Equidæ remains were present.

The milk teeth and the unworn permanent molars are preserved, and the characteristic deep restricted preorbital fossa very well shown. The foot bones are metatarsals II, III, IV, three phalanges of digit III, calcaneum, part of navicular, magnum, unciform, etc.; there are also most of the ulno-radius, tibia, three cervical vertebræ and many fragments.

Archæohippus was regarded by Gidley as intermediate between *Hypohippus* and *Parahippus*. The evidence of these specimens indicates that it is much closer to *Parahippus* than to the anchiteriine genera.

The teeth agree except for the lack of any trace of crochet. They share the rugose enamel, the broken protoloph, with protocone half separate, the rounded and well separated metaconid and metastylid, the unreduced $M\frac{3}{3}$. The peculiar type of preorbital fossa, shown clearly in our specimens, as also in the type of *A. ultimus*, is unlike any of the Miocene equines excepting *Parahippus pristinus* of the Lower Rosebud. The ulnar shaft is much reduced but completely separate from the radius as in *Parahippus*. This, however, has no great significance as the animal was immature. The metatarsal is like those of small *Parahippi* and of *Merychippus primus* in that the inner cuneiform has no footing on its head. In *Anchitherium*, *Kalobatippus* and *Hypohippus* the metatarsal has a well developed proximal facet for the inner cuneiform, as also in *Equus*, *Pliohippus*, the European hipparions and the later American species. The shafts of the lateral metatarsals are reduced about as in *Parahippus pristinus*, rather less than *Merychippus primus*, and the cross section of the shaft is round oval as in the protohippine horses generally (including *Parahippus*) in contradistinction to the anchitheriine horses in which it retains the flat form of *Mesohippus*. The phalanges are moderately elongated as in *Parahippus* and the protohippine horses, in contrast to the very short, wide and flattened phalanges of the anchitheriine horses (including *Mesohippus*).

The above data show that *Archæohippus* is very closely related to *Parahippus*, and belongs without question in the protohippine group, not in the anchitheriine group. Whether it is deserving of generic separation is very doubtful; it certainly does not represent, as Gidley at first considered, a third phylum of Miocene brachyodont horses as different from *Hypohippus* and *Parahippus* as these are from each other. *Parahippus* includes, indeed, a wide variety of species and should probably be split up into a number of subgenera. Of these, *Archæohippus* might be one, and should probably include *P. pristinus* as well as *A. ultimus*, *penultimus* and *mourningi*.

AMERICAN MUSEUM NOVITATES

Number 541 Published by The American Museum of Natural History New York City June 16, 1932

59.9, 32 C (8)

THE TAXONOMIC HISTORY OF THE SOUTH AMERICAN CRICETID GENERA *EUNEOMYS* (SUBGENERA *EUNEOMYS* AND *GALENOMYS*), *AULISCOMYS*, *CHELEMYSCUS*, *CHINCHILLULA*, *PHYLLOTIS*, *PARALOMYS*, *GRAOMYS*, *ELIGMODONTIA* AND *HESPEROMYS*

By G. H. H. Tate

This is the second of a series of short papers on the systematic status of Neotropical mice The intention is to concentrate in one article the scattered taxonomic information of the genera and species in question and to present it in such form that it is readily available for subsequent work. The genera treated are close allies and their histories interlock repeatedly.

The history of each successive genus or subgenus is presented in chronological order, and placed after it is a summary setting forth the present status, based upon the opinions of recent writers, of all forms concerned, together with their type localities.

HISTORICAL STATEMENT

Euneomys Coues

Subgenus **Euneomys** Coues

1837. Waterhouse described (p. 17) *Mus micropus* (n sp.) and placed it (p. 21) in *Abrothrix*, n. subg. of *Mus*.

1839. Waterhouse further described (p. 61) *Mus micropus* Waterhouse. He described (p. 72) *Reithrodon chinchilloides* (n. sp.) (later designated by Coues the type of *Euneomys*). He erected (p. 75) *Hesperomys*, n. g., to contain almost all forms of Cricetidæ of the Western Hemisphere. *Micropus* was presumably included in this genus.

1842. Lesson placed (p. 136) *micropus* in *Mus* (*Abrothrix*) and listed (p. 143) *chinchilloides* under *Mus* (*Reithrodon*).

1843. Wagner (p. 520) placed *micropus* in *Hesperomys*, subgenus of *Habrothrix*, and (p. 548) *chinchilloides* in *Reithrodon*.

1867. Fitzinger listed (p. 81) *micropus* under *Habrothrix*, full genus, and *chinchilloides* under *Reithrodon* (p. 76).

1874. Coues (p. 185) erected *Euneomys*, n. subg. of *Reithrodon*, designating *Reithrodon chinchilloides* Waterhouse as its type, but not, however, mentioning *micropus*.

1879. Burmeister (p. 231) kept *chinchilloides* in *Reithrodon* and placed (p. 217) *micropus* in *Habrothrix*, subgenus of *Hesperomys*.

1884. Thomas (p. 457) described *Reithrodon pictus*, n. sp. (ultimately designated type of *Auliscomys*, subgenus of *Euneomys*).

1891. Thomas (in Milne-Edwards) continued to list (p. 29) *chinchilloides* under *Reithrodon*.

1896*a*. Thomas in 'Genera of Rodents' listed *Reithrodon* but ignored *Euneomys* which he presumably still thought of as a subgenus of the former.

1898*c*. Thomas described (p. 279) *Phyllotis garleppi*, n. sp. (later placed in *Galenomys*, subgenus of *Euneomys*).

1898. Trouessart (p. 533) made *Euneomys* a synonym of *Reithrodon*, placing *chinchilloides* and *pictus* in that genus. He listed (p. 536) *micropus* under *Akodon*.

1899. Thomas described (p. 280) *Reithrodon fossor*, n. sp. (ultimately made type of *Chelemyscus*).

1900*d*. Thomas described (p. 467) *Phyllotis sublimis*, n. sp. (later removed to *Auliscomys*).

1901*b*. Thomas compared *Euneomys* with *Phyllotis* and *Reithrodon*, giving it full generic rank. Under it he listed *chinchilloides*, *pictus*, *sublimis*, and *fossor*.

1902*b*. Thomas again wrote of *sublimis* under *Euneomys*

1903. Allen re-characterized *Euneomys* and described (p. 192) *Euneomys petersoni*, n. sp.

1905. Allen further described *petersoni*. He placed *micropus* under *Phyllotis*.

1905. Trouessart now followed Thomas and Allen in recognizing *Euneomys* as a full genus. He listed *chinchilloides* and *petersoni;* also *fossor* and other species, later placed in other groups. *Micropus* was returned to *Akodon*.

1911. Neveu-Lemaire and Grandidier more or less ignored re-allocations of the species by Allen, Thomas, and Trouessart. Their list included: *Euneomys sublimis*, *Reithrodon pictus*, and *Phyllotis sublimis*. *Sublimis*, it will be noted, appeared both in *Euneomys* and in *Phyllotis*.

1912. Thomas described (p. 410) *Euneomys mordax*, n. sp.

1915. Osgood considered (p. 190) *micropus* a *Phyllotis*. He erected *Auliscomys* n. subg. of *Phyllotis* to which he removed *pictus* and *sublimis*, thus leaving only *chinchilloides*, *petersoni*, *mordax*, and *fossor* in *Euneomys*.

1916*a*. Thomas considered (p. 140) that *Auliscomys* Osgood should be a subgenus of *Euneomys* rather than of *Phyllotis* and divided (pp. 142–3) the genus *Euneomys* into three subgenera: *Euneomys* subg., *Auliscomys* subg., and *Galenomys* subg. In the first were included *chinchilloides*, *fossor*, *mordax*, and *petersoni*. *Micropus* was placed under *Auliscomys*. *Galenomys*, n. subg., of *Euneomys*, was erected to contain *Phyllotis garleppi*.

1916*b*. Thomas described (p. 185) *Euneomys ultimus*, n. sp.

1919*a*. Thomas described (p. 202) *Euneomys micropus alsus*, n. subsp.

1919*c*. Thomas described (p. 127) *Euneomys dabbenei*, n. sp.

1925. Thomas removed *fossor* from *Euneomys* by designating it type of *Chelemyscus*, n. g.

1926*a*. Thomas, by using *Auliscomys* in full generic sense, left only *Euneomys* (restricted, 1916*a*) and *Galenomys* as subgenera of *Euneomys*, full genus.

1927*b*. Thomas once more listed *micropus alsus* under *Euneomys*.

Subgenus GALENOMYS Thomas

1898*c*. Thomas described (p. 279) *Phyllotis garleppi*, n. sp.

1916*a*. Thomas erected (p. 143) *Galenomys*, n. subg. of *Euneomys*, with type species *Phyllotis garleppi* Thomas.

AULISCOMYS Osgood

1837. Waterhouse described (p. 28) *Mus* (*Phyllotis*) *xanthopygus* (n. sp.).

1839. Waterhouse further described (p. 63) *Mus xanthopygus* Waterhouse. After erecting his blanket-genus *Hesperomys* (p. 75), he referred (p. 76) *xanthopygus* to *Hesperomys*, although as one of the species that "depart most from the type."

1842. Lesson listed *xanthopygus* under *Mus* (*Phyllotis*).

1843. Wagner placed *xanthopygus* under *Hesperomys* (*Phyllotis*).

1846. Waterhouse (p. 9) described *Hesperomys boliviensis*, n. sp.

1879. Burmeister put *xanthopygus* in *Hesperomys* (*Calomys*).

1884. Thomas described (p. 457) *Reithrodon pictus*, n. sp. (later made the type of *Auliscomys*).

1891. Thomas (in Milne-Edwards) listed *xanthopygus* under *Hesperomys* (*Phyllotis*).

1898. Trouessart, treating *Euneomys* as a synonym of *Reithrodon*, listed *pictus* under the latter. He placed *boliviensis* and *xanthopygus* under *Phyllotis*.

1900*d*. Thomas described (p. 457) *Phyllotis sublimis*, n. sp.

1901*a*. Allen listed *boliviensis* under *Phyllotis*.

1901*b*. Thomas considered *sublimis* allied to *pictus*. He reinstated *Euneomys*, listing in it *pictus* and *sublimis* (later to be placed in *Auliscomys*) as well as *E. chinchilloides* and *E. fossor*.

1902*b*. Thomas listed *Euneomys sublimis*.

1902*c*. Thomas listed *Phyllotis boliviensis* and *Euneomys sublimis*.

1902*e*. Thomas described (p. 248) *Phyllotis boliviensis flavidior*, n. subsp.

1905. Allen listed *xanthopygus* under *Phyllotis*.

1905. Trouessart, treating *Euneomys* as a full genus, listed in addition to other forms *pictus* and *sublimis* (later removed to *Auliscomys*). He placed *boliviensis boliviensis, boliviensis flavidior* and *xanthopygus* in *Phyllotis*.

1915. Osgood erected *Auliscomys*, n. subg. of *Phyllotis*, designating as type *Reithrodon pictus* Thomas, and including also *sublimis*, *boliviensis boliviensis* and *boliviensis flavidior*, but not *xanthopygus*. He described (p. 191) *Phyllotis* (*Auliscomys*) *decoloratus*, n. sp.

1916*a*. Thomas considered (p. 140) *Auliscomys* closer to *Euneomys* than to *Phyllotis* and (p. 143) definitely made it a subgenus of *Euneomys*. He added to Osgood's species *micropus* (later taken into *Euneomys* (restricted) and *xanthopygus*).

1919*a*. Thomas referred *xanthopygus* back once more to *Phyllotis*. He described (p. 202) *Euneomys micropus alsus*, n. sp. (*micropus* being at that time in the subgenus *Auliscomys*).

1919*d*. Thomas described (p. 129) *Euneomys* (*Auliscomys*) *leucurus*, n. sp.

1926*a*. Thomas used the name *Auliscomys* (*A. pictus*) in the full generic sense.

1926*c*. Thomas again employed *Auliscomys* (*A. leucurus*) as a full genus.

1926*e*. Thomas maintained his recent (1919) transfer of *xanthopygus* back to *Phyllotis*.

1927*a*. Thomas selected lectotypes in British Museum collections: *pictus* (p. 150), male, number 85.4.1.34 (is of original series).

1927*b*. Thomas, by use of "*Euneomys micropus alsus*" removed *micropus* from *Auliscomys* to *Euneomys*, *Auliscomys* (1926*a*) being a full genus.

Chelemyscus Thomas

1899. Thomas described (p. 280) *Reithrodon fossor*, n. sp.
1901*b*. Thomas removed *fossor* from *Reithrodon* to *Euneomys*.
1905. Trouessart listed *fossor* under *Euneomys*.
1925. Thomas erected (p. 584) *Chelemyscus*, n. g., designating "*Euneomys fossor*" (=*Reithrodon fossor*) type.

Chinchillula Thomas

1898*c*. Thomas erected (p. 280) *Chinchillula*, n. g., with type species *Chinchillula sahamæ*, n. sp.

Andinomys Thomas

1902*a*. Thomas erected (p. 116) *Andinomys*, n. g., with type species *Andinomys edax*, n. sp.

Irenomys Thomas

1900. Philippi described (p. 63) *Reithrodon longicaudatus*, n. sp.
1905. Trouessart mentioned the species in a footnote appended to the genus *Phyllotis*.
1919*a*. Thomas, having received an animal which he considered identical with Philippi's species, erected (p. 201) *Irenomys*, n. g., and designated as type *Reithrodon longicaudatus* Philippi.

Phyllotis Waterhouse

1837. Waterhouse (p 27) proposed *Phyllotis* (n. subg.) of the Linnæan *Mus*, to include three species: *Mus* (*Phyllotis*) *darwini* (n. sp.); *Mus* (*Phyllotis*) *xanthopygus* (n. sp.); and *Mus* (*Phyllotis*) *griseo-flavus* (n. sp.) (now type of *Graomys*). No species was designated type.
1839. Waterhouse (pp. 62–65) further described the above three species under *Mus*, without employing the name *Phyllotis*. By setting up the blanket genus *Hesperomys* he placed these species in that genus.
1843. Wagner placed *darwini*, *griseo-flavus* and *xanthopygus* under *Hesperomys* (*Phyllotis*).
1846. Waterhouse described (p. 483) *Hesperomys boliviensis* n. sp. (finally placed in *Auliscomys*).

1879. Burmeister (p. 225) put "*xanthopygos*" under *Hesperomys* (*Calomys*).

1884. Thomas re-characterized *Phyllotis* as a subgenus of *Hesperomys* and designated *H. darwini* type, listing in addition *boliviensis*, *griseoflavus* and *xanthopygus*.

1891. Thomas (in Milne-Edwards) listed *xanthopygus* under *Hesperomys* (*Phyllotis*).

1896*a*. Thomas in 'Genera of Rodents' made *Phyllotis* a full genus.

1898*c*. Thomas described (p. 279) *Phyllotis? garleppi*, n. sp. (later made the type of *Galenomys*).

1898*d*. Thomas described (p. 270) *Phyllotis haggardi*, n. sp.

1898. Trouessart listed under *Phyllotis: darwini* and *xanthopygus* and also *boliviensis*, *auritus* and *griseo-flavus* (all now in other genera). In his *appendix* he added *haggardi* Thomas and *garleppi* Thomas.

1900*a*. Thomas described (p. 151) *Phyllotis gerbillus*, n. sp. (later made the type of *Paralomys*).

1900*b*. Thomas described (p. 355) *Phyllotis amicus*, n. sp.

1900*c*. Thomas described (p. 296) *Phyllotis amicus maritimus* n. subsp. and (p. 297) *Phyllotis amicus montanus*, n. subsp.

1900*d*. Thomas described (p. 467) *Phyllotis sublimis*, n. sp. (later placed in *Auliscomys*).

1900. Philippi described under *Mus: dichrous*, *mollis*, *illapelinus*, *segethi*, and *campestris*, all of which were later (1910) synonymized by Wolffsohn with *darwini*.

1901*a*. Allen described (p. 44) *Phyllotis osilæ*, n. sp.

1901*b*. Allen described (p. 408) *Phyllotis chacoensis*, n. sp., and (p. 409) *Phyllotis cachinus*, n. sp. (both eventually placed in *Graomys*).

1901*b*. Thomas remarked upon "*Phyllotis*" *sublimis*, which, after comparing the genera *Phyllotis*, *Reithrodon* and *Euneomys*, he placed in *Euneomys*.

1902*b*. Thomas described (p. 131) *Phyllotis wolffsohni*, n. sp., and (p. 131) *Phyllotis lutescens*, n. sp.

1902*c*. Thomas described (p. 224) *Phyllotis arenarius*, n. sp., and (p. 225) *Phyllotis hirtipes* n. sp. (later removed to *Eligmodontia*).

1902*e*. Thomas described (p. 248) *Phyllotis boliviensis flavidior*, n. subsp. (later removed with *b. boliviensis* to *Auliscomys*).

1905. Allen, after discussing *Phyllotis*, listed in it *micropus* (now in *Euneomys*) and *xanthopygus*.

1905. Trouessart transferred *griseo-flavus*, *griseo-flavus centralis*, *cachinus* and *chacoensis* to *Eligmodontia.* Under *Phyllotis* he listed *darwini*, *wolffsohni*, *haggardi*, *lutescens*, *amicus* and its subspecies, *osilæ*, *arenarius* and *xanthopygus*, and as well: *boliviensis*, *boliviensis flavidior*, *hirtipes*, *gerbillus*, *garleppi* and *auritus* (all later placed in other genera).

1910. Wolffsohn synonymized a number of Philippi's (1900) species of *Mus* with *Phyllotis darwini.*

1912. Thomas described (p. 406) *Phyllotis magister*, n. sp., *Phyllotis darwini posticalis*, *Phyllotis darwini limatus*, n. sp., *Phyllotis darwini tucumanus*, n. subsp., *Phyllotis darwini vaccarum*, n. subsp., *Phyllotis andium*, n. sp.

1913*a*. Thomas described (p. 139) *Phyllotis elegantulus*, n. sp.

1913*b*. Thomas described (p. 407) *Phyllotis melanius*, n. sp.

1914. Osgood described (p. 165) *Phyllotis andium stenops*, n. subsp., and (p. 165) *Phyllotis tamborum*, n. sp.

1915. Osgood removed (p. 190) *sublimis*, *boliviensis* and its subspecies to *Auliscomys*, n. subg. of *Phyllotis.* He described (p. 189) *Phyllotis definitus*, n. sp.

1916*a*. Thomas, discussing the relationships of *Phyllotis* and its allies, transferred *Auliscomys* from *Phyllotis* to *Euneomys.* He removed *hirtipes*, *griseo-flavus*, *cachinus*, *chacoensis*, *boliviensis*, *sublimis*, *xanthopygus* and *garleppi*, which had previously been considered members of the genus *Phyllotis*, to other genera. This left in *Phyllotis: darwini* and its subspecies, *haggardi*, *gerbillus*, *amicus* and subspecies, *osilæ*, *wolffsohni*, *lutescens*, *arenarius*, *magister*, *andium* and subsp., *elegantulus*, *melanius*, *tamborum* and *definitus*.

1918*a*. Thomas described (p. 408) *Phyllotis darwini tucumanus*, n. subsp.

1919*a*. Thomas returned *xanthopygus* from *Auliscomys* to *Phyllotis* (see Thomas, 1916).

1919*b*. Thomas raised *darwini tucumanus* to full specific rank and described (p. 493) *Phyllotis ricardulus*, n. sp.

1921*a*. Thomas described (p. 611) *Phyllotis nogalaris*, n. sp.

1922. Anthony described (p. 1) *Phyllotis fruticicollus*, n. sp.

1924. Anthony described (p. 1) *Phyllotis fuscus*, n. sp.

1926*a*. Thomas described (p. 316) *Phyllotis abrocodon*, n. sp. He removed *gerbillus* to *Paralomys*.

1926*d*. Thomas reduced *tamborum* Osgood to the rank of a subspecies of *andium* Thomas.

1926. Cabrera described (p. 319) *Phyllotis oreigenus,* n. sp.
1927*a*. Thomas selected as lectotype of *xanthopygus* British Museum No. 55.12.24.185 and as lectoparatypes 55.12.24.169/170.

Paralomys Thomas

1900*a*. Thomas described (p. 151) *Phyllotis gerbillus,* n. sp.
1926*a*. Thomas erected (p. 315) *Paralomys,* n. g., with type species *Phyllotis gerbillus* Thomas.

Graomys Thomas

1837. Waterhouse described (p. 28) *Mus* (*Phyllotis*) *griseo-flavus* (n. sp.).
1839. Waterhouse further described (p. 62) *griseo-flavus* Waterhouse under *Mus,* no longer using *Phyllotis.* He placed (p. 76) *griseo-flavus* in *Hesperomys,* n. g.
1842. Lesson listed *griseoflavus* under *Mus* (*Phyllotis*).
1843. Wagner gave *griseo-flavus* under *Hesperomys* (*Phyllotis*).
1879. Burmeister placed *griseo-flavus* in *Hesperomys* (*Calomys*).
1884. Thomas listed *griseo-flavus* under *Hesperomys* (*Phyllotis*).
1894. Matchie listed *griseo-flavus* under *Phyllotis.*
1898*a*. Thomas listed *griseo-flavus* under *Phyllotis.*
1898*b*. Thomas listed *griseo-flavus* under *Eligmodontia.*
1898. Trouessart listed *griseo-flavus* under *Phyllotis.*
1900. Philippi listed *Mus griseo-flavus* (but Wolffsohn (1910) corrected the identification to *Phyllotis darwini*).
1901*b*. Allen described (p. 408) *Phyllotis chacoensis,* n. sp., and *Phyllotis cachinus,* n. sp.
1902*b*. Thomas described (p. 132) *Eligmodontia dormorum,* n. sp.
1902*d*. Thomas described (p. 240) *Eligmodontia griseoflavus centralis,* n. subsp., thus removing *griseoflavus* from *Phyllotis* to *Eligmodontia.*
1905. Allen retained *griseo-flava* under *Eligmodontia.*
1905. Trouessart listed under *Eligmodontia* the following: *griseo-flava, griseo-flava centralis, dormorum, cachinus, chacoensis.* He included also *callosa* and *callosa boliviæ* (now in *Hesperomys*).
1910. Wolffsohn corrected Philippi's (1900) identification of *griseo-flavus.*
1916*a*. Thomas (p. 141) erected *Graomys,* n. g., designating as type *Mus* (*Phyllotis*) *griseo-flavus* Waterhouse, to include a number of the forms hitherto referred to *Eligmodontia.* Species listed were *griseo-flavus centralis, chacoensis, cachinus* and *dormorum*

1916. Osgood, considering *Graomys* a subgenus, used the combination "*Phyllotis* (*Graomys*) *dormorum*." He thought that *Phyllotis amicus* should be placed near *Graomys*.

1918*a*. Thomas restored *Graomys* to full generic rank, describing (p. 187) *Graomys lockwoodi*, n. sp.

1919*b*. Thomas described (p. 494) *Graomys medius*, n. sp., and (p. 495) *Graomys edithæ*, n. sp.

1926*b* Thomas described (p. 320) *Graomys taterona*, n. sp.

ELIGMODONTIA Cuvier

1837. Cuvier erected (p. 168) *Eligmodontia*, n. g., with type *typus*, n. sp. (construed as by original designation).

1837. Waterhouse described (p. 19) *Mus elegans* (n. sp.) and referred it (p. 21) to his *Mus* (*Calomys*).

1839. Waterhouse further described (p. 41) *elegans* Waterhouse, this time under *Mus* (and omitting *Calomys*). He referred (p. 75) almost all American Cricetidæ to *Hesperomys*, n. g., his all-inclusive genus.

1841. Wagner placed (p. 125) the genus "*Elimodon*" under his division Sigmodontes.

1843. Wagner placed (p. 525) *elegans* under *Hesperomys* (*Calomys*). *Eligmodontia typus* was made a synonym of *Mus elegans*.

1847. D'Orbigny and Gervais listed *Eligmodontia typus* and placed immediately after the reference to Cuvier's description "(d'après un exemplaire receuilli par M. d'Orbigny)." They then spoke of capturing it in Corrientes (see Thomas, 1929).

1874. Coues stated (p. 177) that "*Eligmodontia* was no earlier" than *Calomys* and (p. 176) listed *Eligmodontia* as a synonym of *Calomys*.

1879. Burmeister listed (p. 220) *elegans* under *Hesperomys* (*Calomys*) and in a note (p. 221) claimed that *Eligmodontia typus* was distinct from *elegans* and equalled *Oryzomys longicaudatus* (Bennett).

1896*b*. Thomas described (p. 307) "*Eligmodon*" (emendation or misprint for *Eligmodontia*) *moreni*, n. sp.

1898*b*. Thomas included "provisionally" in *Eligmodontia: elegans* (=*typus*), *moreni*, as well as a number of species which now are referred to other genera.

1898. Trouessart reduced both *Calomys* and *Hesperomys*, placing them as synonyms of *Eligmodontia*. Besides *typus* (=*elegans*) and *moreni* he listed several species now located in other genera.

1900*c*. Thomas described (p. 297) *Eligmodontia sorella*, n. sp. (later removed to *Hesperomys*).

1901*b*. Allen described (p. 409) *Eligmodontia morgani*, n. sp. and spoke of *griseo-flavus* (now in *Graomys*) as in *Eligmodontia*.

1901*a*. Thomas described (p. 182) *Eligmodontia ducilla*, n. sp. (later transferred to *Hesperomys*).

1901*b*. Thomas described (p. 253) *Eligmodontia callosa boliviæ*, n. subsp. (later placed in *Hesperomys*).

1902*b*. Thomas described (p. 132) *Eligmodontia dormorum*, n. sp. (later placed in *Graomys*) and *Eligmodontia carilla* (transferred to *Hesperomys*).

1902*c*. Thomas described (p. 225) *Phyllotis hirtipes*, n. sp. (in 1916 transferred to *Eligmodontia*).

1902*d*. Thomas described (p. 240) *Eligmodontia griseo-flavus centralis*, n. subsp. (transferred later to *Graomys*).

1904. Palmer (p. 154) held *Calomys* Waterhouse preoccupied by *Callomys* d'Orbigny and Geoffroy, 1830. Cited various modifications in spelling (p. 225) of *Eligmodontia*.

1905. Allen argued that because *Hesperomys* was a synonym of *Calomys* and *Calomys* was a synonym of *Eligmodontia*, therefore *Hesperomys* was a synonym of *Eligmodontia*. His contention was based upon the assumption that *elegans* and *bimaculatus* were congeneric. They are not considered to be so today. Besides *typus* (=*elegans*) and *morgani* he listed *gracilipes* (now in restricted *Hesperomys*) and *griseo-flavus* (now in *Graomys*).

1905. Trouessart considered *Hesperomys* as a synonym of *Eligmodontia*. Only *typus*, *morgani* and *moreni* of the species listed by him are now included in *Eligmodontia*. He placed *hirtipes* in *Phyllotis*.

1913*a*. Thomas described (p. 138) *Eligmodontia laucha musculina*, n. subsp. (later placed in restricted *Hesperomys*). Thus, he still considered *Eligmodontia* and *Hesperomys* synonymous.

1913*c*. Thomas described (p. 572) *Eligmodontia morgani pamparum*, n. subsp.

1916*a*. Thomas split up the old *Eligmodontia* into *Eligmodontia* (restricted), *Hesperomys* (restricted) and *Graomys*. In the restricted *Eligmodontia* were left only *typus*, *moreni*, *morgani* and *morgani pamparum*. From *Phyllotis*, *hirtipes* was transferred to *Eligmodontia*.

1918*b*. Thomas described (p. 483) *Eligmodontia marica*, n. sp.

1919*d*. Thomas described (p. 131) *Eligmodontia hirtipes jucunda*, n. subsp.

1926. Shufeldt (pp. 508, 568) referred to *tener* Winge (a *Hesperomys*) as *Eligmodontia*.

1929. Thomas interpreted the remarks of d'Orbigny and Gervais (1847) as showing that Cuvier's animal (the type) was collected by d'Orbigny in Corrientes, "Buenos Aires" having only a general significance. He revived *elegans*, for nearly a century synonymized with *typus*, as a separate southern species until such time as the status of each could be determined. He suggested that perhaps *morgani* and also *m. pamparum* were synonymous with *elegans*.

HESPEROMYS Waterhouse

1801. Azara described (p. 102) his "Rat septième ou rat laucha" (which appears to have been a *Hesperomys*).

1802. Azara characterized the same rat in his Spanish edition as "laucha."[1]

1819. Desmarest applied (p. 65) the binomial *Mus laucha* to Azara's description (in the French edition).

1827. Brants recorded (p. 148) *laucha* under *Mus*.

1830. Rengger described (p. 231) *Mus callosus* (n. sp.).

1830. Geoffroy and d'Orbigny described *Callomys*, n. g. for a species of viscacha.

1837. Waterhouse described (p. 18) *Mus bimaculatus* (n. sp.) and (p. 19) *Mus gracilipes* (n. sp.). He erected (p. 21) *Calomys*, n. subg. of *Mus*, designating *bimaculatus* as type and including *gracilipes*. (*Calomys*, however, was preoccupied by *Callomys* Geoffroy and d'Orbigny, 1830).

1839. Waterhouse re-characterized (p. 43) *bimaculatus* and (p. 45) *gracilipes*. He compared (p. 74) the teeth of an example (*Mus bimaculatus*) of American Muridæ with the dentition of *Mus rattus*. The distinct characters of the teeth induced

[1]The description of BLANCO DEBAXO, p. 97, named *Mus dubius* Fischer, 'Synopsis Mammalium,' 1829, p. 326, referred almost certainly to a species of *Hesperomys*.

him "to separate the South American mice from those of the Old World,—or rather from that group of which *M. decumanus* may be regarded as the type,—and to place them, together with such North American species as agree with them in dentition, in a new genus bearing the name *Hesperomys*."

"The species of *Hesperomys* which depart most from the type . . . recede still farther from the genus *Mus*, and approach more nearly (as regards the dentition) to the *Arvicolae*. Among the species here described I may mention as examples, *M. griseoflavus, M. xanthopygus* and *M. darwinii*, . . . and among the North American species . . . *Neotoma*."

". . . in the species of *Hesperomys*, the molar teeth are always rooted, . . ."

[The above quotations are introduced to emphasize the breadth of Waterhouse's original conception of *Hesperomys*. The genus has since been gradually restricted until its present scope has been reached. Coues (1874) and Allen (1905) suggested that *bimaculatus* OUGHT to be considered the type of *Hesperomys*, but it remained for Thomas (1916) formally to designate it such. It will be noted that with *Hesperomys* and *Calomys* having the same type species (*bimaculatus*), the former might be a synonym of the latter. But because *Calomys* was preoccupied, *Hesperomys* became valid.]

1841. Lund (p. 280) briefly described *Mus expulsus* (n. sp.).

1842. Lesson placed *expulsus* and *laucha* in his subgenus *Mus*.

1843. Gray raised *Calomys* to generic rank.

1843. Wagner diagnosed *Hesperomys*, including in it as subgenera *Oxymycterus, Scapteromys, Habrothrix, Calomys, Phyllotis* and two subgeneric groups which he left unnamed. *Bimaculatus, gracilipes* and other mice were put in *Calomys*, but *expulsus, laucha* and *callosus* remained unplaced subgenerically. *Holochilus* was a separate genus.

1854. Burmeister used *Hesperomys* in the broad sense to include several subgenera. He placed *elegans* and *expulsus* in *H.* (*Calomys*).

1859. Baird further restricted *Hesperomys* by dividing it into three South American subgenera, *Calomys* (=*Eligmodontia*), *Habrothrix* (=*Habrothrix*+*Phyllotis*) and *Oxymycterus* (=*Oxymycterus*+*Scapteromys*), and two North American subgenera, *Onychomys* and *Oryzomys*. *Reithrodon* and

Holochilus were considered full genera. The species now called *Peromyscus* were still kept in the subgenus *Hesperomys*.

1867. Fitzinger made all subgenera into full genera, but confused his species hopelessly.

1874. Coues reviewed (p. 177) Baird's treatment. He separated the North American vesper mice under the name *Vesperimus*, n. subg. (a synonym of *Peromyscus* Gloger). He suggested (designated ?) that *bimaculatus* be taken as the type of *Hesperomys*.

1879. Burmeister listed a series of subgenera (*Holochilus*, *Oxymycterus*, *Habrothrix* and *Calomys*) under *Hesperomys*.

1884. Thomas described (p. 454) *Hesperomys* (*Calomys*) *bimaculatus lepidus*, n. subsp.

1887. Winge placed *Mus expulsus* Lund in *Hesperomys*. His other species given under that genus are now located in other genera. He described (p. 15) *Hesperomys tener*, n. sp. The species treated under *Calomys* appear to belong in *Oryzomys*.

1888. Thomas suggested that *Hesperomys* be merged with *Cricetus* and the former name be done away with.

1891. Allen stated (p. 291) that *Hesperomys*, on account of its anomalous history, was not entitled to recognition in nomenclature.

1894. Thomas described (p. 359) *Oryzomys? venustus*, n. sp.

1896*a*. Thomas in 'Genera of Rodents' considered *Hesperomys* a synonym of *Eligmodontia*.

1897. Palmer in 'Generic and Family names of Rodents' under "type or included species" gave *Mus bimaculatus* for *Hesperomys*.

1898. Trouessart listed *Hesperomys* as a synonym of *Eligmodontia*. Besides species truly belonging in the latter, he listed *bimaculatus bimaculatus*, *bimaculatus lepidus*, *bimaculatus laucha* and *gracilipes*. He placed *expulsus*, *tener*, *venustus* and *simplex* in *Oryzomys* and *callosus* in *Phyllotis*.

1900*c*. Thomas described (p. 297) *Eligmodontia sorella*, n. sp. (later removed to *Hesperomys*).

1901*a*. Thomas described (p. 182) *Eligmodontia ducilla*, n. sp. (later placed in *Hesperomys*).

1901*b*. Thomas described (p. 253) *Eligmodontia callosa boliviæ*, n. subsp. (later brought into *Hesperomys*).

1902*b*. Thomas described *Eligmodontia carilla*, n. sp. (later placed in *Hesperomys*).

1902*d*. Thomas listed *callosa* under *Eligmodontia*.

1904. Palmer said of *Hesperomys*, "type not designated, but *Mus bimaculatus* . . . may perhaps be so considered."

1905. Allen followed Trouessart (1898) and made *Hesperomys* a synonym of *Eligmodontia*. Taking *bimaculatus* as the type of *Hesperomys*, he contended that since *bimaculatus* was designated type of *Calomys*, *Hesperomys* must remain a synonym of *Calomys*. Furthermore he concluded that because *Calomys elegans* was equal to *Eligmodontia typus*, *Calomys* (and therefore *Hesperomys*) was synonymous with *Eligmodontia*. Such a conclusion was only warranted if *elegans* and *bimaculatus* were truly congeneric.
Allen re-described *gracilipes*.

1905. Trouessart, following Allen, made *Hesperomys* a synonym of *Eligmodontia*. Of animals today considered as *Hesperomys* he listed *callosus callosus*, *callosus boliviæ*, *bimaculatus*, *lepidus* (making it a full species), *sorella*, *ducilla*, *laucha*, *carilla* and *gracilipes*. He placed *expulsus* in *Zygodontomys;* and still held *simplex*, *tener* and *venustus* in *Oryzomys*.

1913*a*. Thomas described (p. 138) *Eligmodontia laucha musculina*, n. subsp.

1916*a*. Thomas limited the genus *Eligmodontia*, as viewed during the previous score of years, by reinstating *Hesperomys* (available because of the preoccupation of *Calomys*) in restricted form, by strongly restricting *Eligmodontia* itself, and by erecting *Graomys* for the *griseo-flavus* group. The restricted *Hesperomys* was re-characterized (p. 141), *Mus bimaculatus* Waterhouse being designated the type. Othr species listed were: *callosus*, *callosus boliviæ*, *carilla*, *ducilla*, *expulsus*, *gracilipes*, *laucha*, *laucha musculinus*, *lepidus*, *sorella*, *tener* and *venustus*.

1916*b*. Thomas wrote upon the *laucha* group, and described also (p. 182) *Hesperomys venustus callidus*, n. subsp., *Hesperomys murillus*, n. sp., and *Hesperomys murillus cordovensis*, n. subsp.

1917. Thomas described (p. 1) *Hesperomys frida*, n. sp., and (p. 1) *Hesperomys carillus marcarum*, n. subsp.

1919*d*. Thomas described (p. 130) *Hesperomys carillus argurus*, n. subsp.

1920. Thomas described (p. 190) *Hesperomys musculinus cortensis*, n. subsp., thus raising *musculinus* to full specific rank.

1921*b*. Thomas described (p. 623) *Hesperomys muriculus*, n. sp.
1926. Shufeldt spoke of *tener* as "*Eligmodontia*."
1926*a*. Thomas described (p. 314) *Hesperomys frida miurus*, n. subsp.
1926*b*. Thomas described (p. 321) *Hesperomys fecundus*, n. sp.
1927*a*. Thomas, in 'Selection of Lectotypes,' listed the type of *bimaculatus* as British Museum No. 55.12.24.172 and a lectoparatype (in alc.) as 55.12.26.288.

PRESENT STATUS OF THE GENERA

Genus *Euneomys* Coues	Type by original designation: *Reithrodon chinchilloides* Waterhouse
Subgenus *Euneomys* Coues (Modified by Thomas, 1916)	
Subgenus *Galenomys* Thomas (1916)	Type by original designation: *Phyllotis garleppi* Thomas
Genus *Auliscomys* Osgood (Modified by Thomas, 1916, 1926)	Type by original designation: *Reithrodon pictus* Thomas
Genus *Chelemyscus* Thomas	Type by original designation: *Reithrodon fossor* Thomas
Genus *Chinchillula* Thomas	Type by original designation: *Chinchillula sahamae* Thomas
Genus *Andinomys* Thomas	Type by original designation: *Andinomys edax* Thomas
Genus *Irenomys* Thomas	Type by original designation: *Reithrodon longicaudatus* Philippi
Genus *Phyllotis* Waterhouse	Type by subsequent designation (Thomas): *Mus* (*Phyllotis*) *darwini* Waterhouse
Genus *Paralomys* Thomas	Type by original designation: *Phyllotis gerbillus* Thomas
Genus *Graomys* Thomas	Type by original designation: *Mus* (*Phyllotis*) *griseo-flavus* Waterhouse
Genus *Eligmodontia* Cuvier	Type by monotypy and original designation: *Eligmodontia typus* Cuvier
Genus *Hesperomys* Waterhouse	Type by subsequent designation (Thomas): *Mus bimaculatus* Waterhouse

LIST OF APPARENT[1] SPECIES AND SUBSPECIES WITH TYPE LOCALITIES

Euneomys (*Euneomys*)	
chinchilloides (Waterhouse)	"South shore of the Strait of Magellan, near the Eastern entrance"
micropus micropus (Waterhouse)	Santa Cruz, Argentina
micropus alsus Thomas	Maiten, Western Chubut, Argentina

[1]No responsibility for the allocation of these forms is assumed.

petersoni Allen	Upper Rio Chico de Santa Cruz, Argentina
mordax Thomas	Fort San Rafael, Mendoza, Argentina
ultimus Thomas	St. Martin's Cove, Hermite Island, Cape Horn Islands
dabbenei Thomas	Lago Viedma, Santa Cruz, Argentina
Euneomys (*Galenomys*)	
garleppi (Thomas)	Near Mt. Sahama, Puna region, Bolivia
Auliscomys	
pictus (Thomas)	Junin (town), Peru
boliviensis boliviensis (Waterhouse)	Near Potosi, Bolivia
boliviensis flavidior (Thomas)	Bateas, Caylloma, Peru
sublimis (Thomas)	Rinconado Malo pass, above Caylloma, Peru
decoloratus (Osgood)	Tirapata, Puno, Peru
leucurus (Thomas)	LaLagunita, Maimara, Jujuy, Argentina
Chelemyscus	
fossor (Thomas)	Province of Salta, Argentina
Chinchillula	
sahamæ Thomas	Mt. Sahama, Puna region, Bolivia
Andinomys	
edax Thomas	El Cabrado, between Potosi and Sucre, Bolivia
Irenomys	
longicaudatus (Philippi)	Western coast of Patagonia (Thomas's specimen from Beatriz, Nahuel Huapi, Argentina)
Phyllotis	
darwini darwini (Waterhouse)	Coquimbo, Chile
darwini posticalis Thomas	Galera, west of Oroya, Junin, Peru
darwini limatus Thomas	Chosica, near Lima, Peru
darwini vaccarum Thomas	Las Vacas, Argentine slope of Cordillera, opposite Mendoza, Argentina
xanthopygus (Waterhouse)	Santa Cruz, Argentina
haggardi Thomas	Mt. Pichincha, Ecuador
amicus amicus Thomas	Tolon, coast district, Cajamarca, Peru
amicus maritimus Thomas	Eten, coast of N. W. Peru
amicus montanus Thomas	Uramarca, near Pallasca, N. W. Peru
osilæ Allen	Osila, S. E. Peru
wolffsohni Thomas	Tapacari, N. of Cochabamba, Bolivia

lutescens Thomas	Choro, N. of Cochabamba, Bolivia
arenarius Thomas	Uyuni, near Potosi, Bolivia
magister Thomas	Arequipa, Peru
tucumanus (Thomas)	Cumbre de Malamala, Sierra de Tucuman, Argentina
andium andium Thomas	Cañar, Ecuador
andium stenops Osgood	Rio Utcubamba, 15 miles above Chachapoyas, Peru
andium tamborum (Osgood)	Tambo Carrizal, mountains east of Balsas, R. Marañon, Peru
elegantulus Thomas	Pallatanga, Ecuador
melanius Thomas	Porvenir, Bolivar, Ecuador
definitus Osgood	Macate, 50 miles northeast of Chimbote, Peru
nogalaris Thomas	Higuerilla, Jujuy, Argentina
fruticicolus Anthony	Guachanamá, Southern Ecuador
fuscus Anthony	Contrayerbas, Azuay, Ecuador
abrocodon Thomas	Oroya, Peru
oreigenus Cabrera	Laguna Blanca, Catamarca, Chile
Paralomys	
gerbillus (Thomas)	Piura, N. W. Peru
Graomys	
griseo-flavus griseo-flavus (Waterhouse)	Rio Negro, Argentina
griseo-flavus centralis (Thomas)	Cruz del Eje, Central Cordova, Argentina
chacoensis (Allen)	Waikthlatingwayalwa, Chaco boreal, Paraguay
cachinus (Allen)	Upper Cachi River, Salta, Argentina
dormorum (Thomas)	Tapacari, N. of Cochabamba, Bolivia
lockwoodi Thomas	Manuel Eldori, Vermejo, Salta, Argentina
medius Thomas	Chumbiche, Catamarca, Argentina
edithæ Thomas	Otro Cerro, northeast Rioja, Argentina
taterona Thomas	Tablada, Tarija, S. Bolivia
Eligmodontia	
typus Cuvier	Buenos Aires (Cuvier), but see Thomas (1929)
elegans (Waterhouse)	Bahia Blanca, Argentina
morgani morgani Allen	Arroyo Else, Patagonia
morgani pamparum Thomas	Peru Station, F. C. P., about 200 km. northwest of Bahia Blanca, Argentina
moreni Thomas	Chilecito, Rioja, Argentina
hirtipes hirtipes (Thomas)	Challapata, Bolivia
hirtipes jucunda Thomas	Abrapampa, northwest Jujuy, Argentina
marica Thomas	Chumbiche, Catamarca, Argentina

Hesperomys	
bimaculatus (Waterhouse)	Maldonado, Uruguay
laucha (Desmarest)	Buenos Aires, Argentina
musculinus musculinus (Thomas)	Maimara, Jujuy, Argentina
musculinus cortensis Thomas	Jujuy City, Jujuy, Argentina
callosus callosus (Rengger)	R. Paraguay, between 7th and 20th degrees of south latitude
callosus boliviæ (Thomas)	R. Solocame, Bolivia
gracilipes (Waterhouse)	Bahia Blanca, Argentina
expulsus (Lund)	Lagoa Santa (?), Brazil
lepidus lepidus Thomas	Junin, Peru
tener Winge	Lagoa Santa, Brazil
venustus venustus (Thomas)	Cosquin, Cordova, Argentina
venustus callidus Thomas	Goya, Corrientes, Argentina
sorella (Thomas)	8 miles south of Huamachuca, N. W. Peru
ducilla (Thomas)	San Anton, Lake Titicaca, S. E. Peru
carillus carillus (Thomas)	Choro, Bolivia
carillus marcarum Thomas	Lauramarca, Peru
carillus argurus Thomas	Abrapampa, N. W. Jujuy, Argentina
murillus murillus Thomas	La Plata City, Buenos Aires, Argentina
murillus cordovensis Thomas	Yacanto, Cordova, Argentina
frida frida Thomas	Chospyoc, Peru
frida miurus Thomas	Yana Mayo, Rio Tama, Peru
muriculus Thomas	San Antonio, Parapiti, on 20° S., lat., about 250 km. south of Santa Cruz de la Sierra, Bolivia
fecundus Thomas	Tablada, Tarija, Bolivia

LIST OF REFERENCES

ALLEN, J. A.
1891. Bull. Amer. Mus. Nat. Hist., III, pp. 291–294.
1901*a*. Bull. Amer. Mus. Nat. Hist., XIV, pp. 41–46.
1901*b*. Bull. Amer. Mus. Nat. Hist., XIV, pp. 405–412.
1903. Bull. Amer. Mus. Nat. Hist., XIX, pp. 185–196.
1905. 'Report Princeton Patagonian Expedition,' III, pp. 1–120.

ANTHONY, H. E.
1922. Amer. Mus. Novit., No. 32, pp. 1–6.
1924. Amer. Mus. Novit., No. 114, pp. 1–6.

AZARA, F.
1801. 'Essais Quadr. Paraguay,' II.
1802. 'Apuntamientos Quadr. Paraguay,' II.

BAIRD, S. F.
1859. 'Mammals of North America.'

BRANTS, A. 1827. 'Het geschlacht Muizen . . . ,' p. 148.

BURMEISTER, H. 1854. Abh. Naturf. Ges. Halle, II (1), Sitz., pp. 3-10.

1879. 'Descrip. Phys. Rep. Argentina,' III.

CABRERA, A. 1926. Rev. Chilena Hist. Nat., XXX, pp. 319-321.

COUES, E. 1874. Proc. Acad. Nat. Sci. Phila.

CUVIER, F. 1837. Ann. Sci. Nat. Paris, p. 168.

DESMAREST, A. G. 1819. Nouv. Dict. d'Hist. Nat., 2d Ed., XXIX, pp. 40–71.

FITZINGER, L. J. 1867. Sitzungsber. Akad. Wien, LVI.

GEOFFROY, I., AND D'ORBIGNY, A. D. 1830. Ann. Sci. Nat. Paris, XXI, p. 291.

GRAY, J. E. 1843. 'List. Spec. Mamm. Brit. Mus.,' p. 112.

LESSON, R. P. 1842. 'Nouv. Tabl. Règne Anim.'

LUND, P. W. 1841. Selskabs. k. danske, Vid. Skrifter, (4) VIII, p. 280.

MATSCHIE, P. 1894. Sitz.-ber. Ges. Naturf. Fr., p. 61.

MILNE-EDWARDS, A. 1891. Mission Sci. Cap Horn, VI.

NEVEU LEMAIRE, M., AND GRANDIDIER, G. 1911. Mission Scientifique.

D'ORBIGNY, A. D., AND GERVAIS, P. 1847. 'Voyage Amer. Merid.,' IV, Mamm., p. 24.

OSGOOD, W. H. 1914. Field Mus. Nat. Hist., Zool. Publ., X, pp. 143–185.

1915. Field Mus. Nat. Hist., Zool. Publ., X, pp. 187–198.

1916. Field Mus. Nat. Hist., Zool. Publ., X, pp. 199–216.

PALMER, T. S. 1897. Proc. Biol. Soc. Wash., XI, pp. 241–270.

1904. 'North Amer. Fauna,' No. 23.

PHILIPPI, R. A. 1900. Anales Mus. Nac. Chile, No. 14, pp. 1–70.

RENGGER, J. R. 1830. 'Naturg. Saugethiere Paraguay.'

SHUFELDT, R. W. 1926. Rev. Mus. Paulista, XIV, pp. 508, 568.

THOMAS, O. 1884. Proc. Zool. Soc. London, p. 449.

1888. Proc. Zool. Soc. London, p. 130.

1894. Ann. Mag. Nat. Hist., (6) XIV, p. 346.

1896*a*. Proc. Zool. Soc. London, pp. 1012–1028.

1896*b*. Ann. Mag. Nat. Hist., (6) XVIII, pp. 301–314.

1897. Ann. Mag. Nat. Hist., (6), XX, pp. 214–218.

THOMAS, O.
1898*a*. Bol. Mus. Torino, XIII, xii, p. 4.
1898*b*. Proc. Zool. Soc. London, pp. 210 212.
1898*c*. Ann. Mag. Nat. Hist., (7) I, pp. 277-283.
1898*d*. Ann. Mag. Nat. Hist., (7) II, pp. 265–275.
1899. Ann. Mag. Nat. Hist., (7) IV, pp. 278-288.
1900*a*. Ann. Mag. Nat. Hist., (7) V, pp. 148–153.
1900*b*. Ann. Mag. Nat. Hist., (7) V, pp. 354–357.
1900*c*. Ann. Mag. Nat. Hist., (7) VI, pp. 294-302.
1900*d*. Ann. Mag. Nat. Hist., (7) VI, pp. 466-469.
1901*a*. Ann. Mag. Nat. Hist., (7) VII, pp. 179–190.
1901*b*. Ann. Mag. Nat. Hist., (7) VIII, pp. 246-255.
1902*a*. Proc. Zool. Soc. London, I, p. 116.
1902*b*. Ann. Mag. Nat. Hist., (7) IX, pp. 125-143.
1902*c*. Ann. Mag. Nat. Hist., (7) IX, pp. 222–230.
1902*d*. Ann. Mag. Nat. Hist., (7) IX, pp. 237–245.
1902*e*. Ann. Mag. Nat. Hist., (7) X, pp. 246–250.
1912. Ann. Mag. Nat. Hist., (8) X, pp. 403 411.
1913*a*. Ann. Mag. Nat. Hist., (8) XI, pp. 136-143.
1913*b*. Ann. Mag. Nat. Hist., (8) XI, pp. 404 409.
1913*c*. Ann. Mag. Nat. Hist., (8) XII, pp. 567 574.
1916*a*. Ann. Mag. Nat. Hist., (8) XVII, pp. 139–143.
1916*b*. Ann. Mag. Nat. Hist., (8) XVII, pp. 182–187.
1917. Smiths. Misc. Coll., LXVIII, No. 4, pp. 1–3.
1918*a*. Ann. Mag. Nat. Hist., (9) I, pp. 186–193.
1918*b*. Ann. Mag. Nat. Hist., (9) II, pp. 482-484.

THOMAS, O.
1919*a*. Ann. Mag. Nat. Hist., (9) III, pp. 192 212.
1919*b*. Ann. Mag. Nat. Hist., (9) III, pp. 489 500.
1919*c*. Ann. Mag Nat. Hist., (9) IV, pp 127 128.
1919*d*. Ann. Mag. Nat. Hist., (9) IV, pp. 128 135.
1920. Ann. Mag. Nat. Hist., (9) V, pp. 188-196.
1921*a*. Ann. Mag. Nat. Hist., (9 VIII, pp. 608-617.
1921*b*. Ann. Mag. Nat. Hist., (9) VIII, pp. 622-624.
1925. Ann. Mag. Nat. Hist., (9) XV, pp. 582-586.
1926*a*. Ann. Mag. Nat. Hist., (9) XVII, pp. 313 318.
1926*b*. Ann. Mag. Nat. Hist., (9) XVII, pp. 318 328.
1926*c*. Ann. Mag. Nat. Hist., (9) XVIII, pp. 193 195.
1926*d*. Ann. Mag. Nat. Hist., (9) XVIII, pp. 610-616.
1926*e*. Ann. Mag. Nat. Hist., (9) XVIII, pp. 635-641.
1927*a*. Ann. Mag. Nat. Hist., (9) XIX, pp 545 554.
1927*b*. Ann. Mag. Nat. Hist., (9) XIX, pp. 650-658.
1927*c*. Ann. Mag. Nat. Hist., (9) XX, pp. 199 205.
1929. Ann. Mag. Nat. Hist. (10) IV, pp. 35 45.

TROUESSART, E.-L.
1898. 'Cat. Mamm. viv. foss.'
1905. 'Cat. Mamm. viv. foss.,' Supplement.

WAGNER, A.
1841. Arch. f. Naturg., I, p 111.
1843. Schreber's 'Säugethiere,' Supplement III.

WATERHOUSE, G. R.
1837. Proc Zool. Soc. London.
1839. 'Zoology Voyage "Beagle."'
1846. Proc Zool. Soc. London.

WINGE, H.
1887. E. Mus. Lundii, I, pt. 3, pp. 1 178.

WOLFFSOHN, J. A.
1910. Bol. Mus. Nac. Chile, II, pp. 84 102.

AMERICAN MUSEUM NOVITATES

Number 542 | Published by The American Museum of Natural History New York City | June 20, 1932

59 76 (76 2)

A SURVEY OF THE AMPHIBIANS AND REPTILES OF HARRISON COUNTY, MISSISSIPPI

By Morrow J. Allen

The following annotated list, a representative collection of which has been deposited in The American Museum of Natural History, embraces 87 species: 11 salamanders; 21 frogs; 1 alligator; 7 lizards; 32 snakes; and 15 turtles. It is based on collecting carried on from October 1929 to January 1932, in an area extending from the coast of the Gulf of Mexico to a point about twenty miles inland. In addition to the work done by Mr. Stewart Springer and the author, the youth of Biloxi were induced to search the surrounding woods and swamps and the result of their collecting has materially aided in obtaining a survey that otherwise might not have been so complete. Contact with inland inhabitants was also of value in this respect. An accurate check has been kept on only about half of the specimens secured, but an estimate of 2000 for the total number would hardly be excessive.

While Louisiana, Alabama, and western Tennessee have received attention from a herpetological standpoint, Mississippi has been neglected, and even though this list represents but a small portion of the State, nevertheless it fills a gap in our knowledge of the distribution of forms on the Gulf coast.

The chief works relating directly to Mississippi herpetology are Brimley's 'Records of some Amphibians and Reptiles from the Southeastern United States' (1910, Proc. Biol. Soc. Wash., XXIII, pp. 9–18), and Corrington's 'Field Notes on some Amphibians and Reptiles at Biloxi, Mississippi' (1927, Copeia, 165, pp. 98–102). All of the thirty-nine species recorded by Brimley from Bay St. Louis are included in the present paper, with the exception of *Pseudacris occidentalis* and *Thamnophis sackenii*. He lists *Diemyctylus viridescens*, but in my copy of the paper he has noted that the specimens were of a subspecies, and I am inclined to believe that they were referable to *Triturus meridionalis*. Corrington reports twenty-six species, all of which are mentioned in this article except *Bufo americanus*. In almost two and one-half years of intensive collecting the author has examined hundreds of toads and none was found to be of this species. Believing its occurrence in this region

to be extremely doubtful, I am inclined to the opinion that Corrington's examples were referable to *Bufo terrestris*, especially since he does not mention this species.

The region may be divided roughly into two sections. Along the coast occurs a low, flat country of thick swamps, brackish marshes, and wet, acid meadows which are usually dry in summer. The streams are sluggish, winding, and affected by the tides in their lower reaches. Twenty to thirty miles inland there is a region of low hills which to the east slopes off into the Pascagoula Swamp.

Agkistrodon mokasen and *Ambystoma opacum* have not been seen on the coast but both were found in the swampy type of country near Basin, George County.

Because of promiscuous timber cutting in the past, there is an abundance of stumps throughout the second-growth pine woods. Beneath the loose bark of these stumps and fallen logs many species find concealment and situations for temporary hibernation. Uninterrupted hibernation for the winter is usually prevented by the erratic temperatures common to that season. Prevailing southerly winds cause the temperature to rise and a number of the forms bestir themselves, but return to their hiding places when a north wind again brings cold weather.

Midwinter and early spring are usually attended by abundant rain, and while the summers may be rather dry, more frequently they are quite moist. For the coast the average annual precipitation is over sixty inches.

The author is indebted to Mr. Stewart Springer for his work in the field, to Dr. F. N. Blanchard for the identification of certain snakes, to Dr. E. R. Dunn and Dr. A. H. Wright for the identification of *Pseudotriton montanus flavissimus* and *Rana heckscheri*, and especially to Dr. G. K. Noble for his criticisms and advice concerning the manuscript and the identification of the *Pseudacris*.

Part I.—AMPHIBIA

Caudata

Amphiuma means Garden.—A common form in this region, but its secretive habits might easily lead to the misconception that it is rare. Muddy pools in the vicinity of Biloxi have yielded a number of specimens, most of which were taken at night. Heavy rains in the midsummer of 1931 caused the streams to overflow and several examples of varying size were found in the daytime in a backwater along a road on the north shore of the bay of Biloxi.

That this animal is very tenacious of life is shown by the fact that specimens have lived for two or three days after they had been speared. An example two and a half feet long was found on August 19, 1931, and even though its back was broken, with the consequence that it was unable to control the posterior part of its body, it lived for ten days and exhibited no signs of discomfort other than to regurgitate two frogs (*Acris gryllus*).

It is hardy in captivity and capable of abstaining from food for a long period of time. However, it is quite voracious if given the opportunity and has been observed to eat smaller individuals of its own kind, *Siren*, fish, and earthworms.

Triturus meridionalis (Cope).—There is some doubt as to the true status of this form as it is known on the Gulf coast. The check list (1923) defines the range of *meridionalis* as "Southern Georgia to Louisiana, Texas and Tamaulipas." Our specimens agree with a series from Florida and Louisiana.

In Harrison County this species could be considered uncommon, since only about a half-dozen specimens have been secured. A large aquatic adult containing eggs was taken from a ditch in April, 1931. Other examples, found in December, January, and February, were recently metamorphosed. They were discovered within rotten pine stumps and logs in thick woods bordering swamps.

Ambystoma maculatum (Shaw).—Rare. Only one specimen was found, November 21, 1930, beneath a log in a swamp twelve miles south of Vestry near the Harrison–Jackson county-line.

Ambystoma talpoideum (Holbrook).—Not uncommon, as the numbers found during the breeding season indicate, but seldom encountered at other times of the year. On the site of a deserted sawmill close to a large pile of sawdust, on February 12, 1930, eleven specimens were discovered in a hole some three feet deep, at the bottom of which were two or three inches of water. The salamanders were breeding and eggs were present. The two other specimens taken were found beneath leaves near a pond of rain-water on December 2 of the same year.

On April 20, 1931, a large series of larvæ, measuring from 25 to 60 mm., were taken from a pond, and up until May 15 others in different stages of development were found in small pools. When leading a strictly aquatic existence their food seemed to consist largely of mosquito larvæ, though while in the laboratory they also ate readily small bits of

bread and meat. Their cannabilistic tendencies were apparent from the fact that no matter how well fed, they attacked others of their own kind and small tadpoles.

Of the majority of those taken on April 20, the gills were practically absent by May 14, and on the average the specimens had increased about 10 mm. in length. About May 14, a number were found without gills and measuring 55 to 70 mm. These specimens were taken from under logs and among moist leaves in the bed of a dried pool. In coloration they closely resembled the adult, as the striped appearance described below was entirely absent. At the termination of the process of gill absorption, the length of examples varied from 50 to 65 mm.

DESCRIPTION OF LARVÆ.—Length, 25 to 60 mm. Costal grooves, 9 to 10. Width of head in total length 6 times. Length of head in total length 5.2 times. Distance from axilla to snout same as distance from axilla to groin. Digits, 4–5. Tail long, as long as, or longer than the body. A prominent dorsal fin, extending from the head to the end of the tail; a ventral fin, slightly less conspicuous, from the vent to the tip of the tail. Limbs fairly well developed, anterior ones more so than posterior pair, and meeting or overlapping when pressed along the side. Three pairs of prominent gills. Mouth well developed; labial folds present laterally. Eyes small, dorsolateral in position. Head large, depressed. Body compressed.

Fins speckled with black. Dorsally the body is dark, with lighter blotches. On either side a whitish or yellowish stripe extends from the gills to a point just posterior to vent. Below this is a wider, darker band somewhat speckled with the light ventral color. Limbs light, sprinkled with black. Belly light. Throat light, finely sprinkled with darker. Top of head similar to dorsal light blotches. A dark line extends from the snout through the eye to base of gills. A light band just below this and another dark line along jaw extending to base of gills.

Plethodon glutinosus (GREEN).—The commonest salamander of the region. Throughout the winter they are abundant beneath logs in the swamps, but at the approach of warm weather they become scarce in their winter retreats, and with the advent of summer they seem to disappear, as only an occasional one can be found.

This species, as it is found on the coast, is smaller and less spotted than those I have seen in the northern parts of its range. These differences have also been detected upon comparison of a series from Biloxi with a series from about fifty to seventy-five miles inland. Several examples have been discovered in which the spots were totally obsolete.

Manculus quadridigitatus quadridigitatus (HOLBROOK).—Found occasionally under logs in the swamps during the winter and spring. Rarely seen throughout the remaining seasons.

Pseudotriton montanus flavissimus (Hallowell).—Rather a rare species, only four specimens having been taken. On December 17, 1929, a specimen 80 mm. in length was found under the bark of a rotten log on the edge of a swamp. A second one, 88 mm. long, less spotted and of a more uniform color than the preceding, was found nearby in a similar habitat. A year later, December 27, 1930, within fifty yards of the previous captures, a typically spotted individual 93 mm. in length was discovered beneath a log. In November, 1930, another specimen was plowed up in a field south of Vestry.

Eurycea bislineata cirrigera (Green).—A salamander that can scarcely be considered common. It seems to prefer the swamps and other moist places that afford ground-cover. One specimen was taken from the side of a tree, about six feet from the ground, on a rainy night in November, 1930.

Eurycea gutto-lineata (Holbrook).—Seldom seen except during the winter. Two specimens were found under logs in a swamp on February 2, 1930. No more were observed until December 3 of the same year when seven were taken from concealment near a deep pond. At about the same time a lot of nine was brought in from south of Vestry and in the following March, twelve were secured about the margins of the pool mentioned above. On January 1, 1932, two small specimens were found under logs in sandy soil close to a small stream.

Desmognathus fuscus auriculatus (Holbrook).—This species is a common inhabitant of the swamps. It takes advantage of the protection of logs and stumps, provided they are situated in wet places. It seems to be more frequently taken during the winter, being seldom seen throughout the summer.

This is another form that is possibly confined to the Gulf coast and distinct from the Atlantic coastal plain subspecies to which it is here referred.

Siren intermedia LeConte.—A species undoubtedly common in this region but infrequently seen because of its habits. A specimen 275 mm. in length was taken from a roadside ditch near Biloxi on March 9, 1931. Several others of smaller size from the vicinity of Biloxi and two from a spring south of Vestry.

Search among the wet, muddy leaves surrounding a slowly evaporating pond resulted in the discovery of many young 23 to 25 mm. long. The definite color pattern consists of a pale mid-dorsal line from the

posterior extremity of head to the end of tail; a yellow transverse line on dorsal surface of head; a yellow mark above the eyes; snout yellow; a yellow line along side of head below eye; ground color black. These young seemed to be quite delicate and attempts to keep them alive proved unsuccessful. They were found on April 28, 1931, in company with the larvæ of *Eurycea gutto-lineata* at the same pond where the adults of the latter species had been taken previously.

Salientia

Scaphiopus holbrookii holbrookii (Harlan).—This species has been met with four different times. On the night of October 15, 1930, during a hard rain, eighteen specimens were secured. A rainy night in the following March yielded 219 specimens from ponds in which they were breeding. Four others were found south of Vestry, likewise at night in a hard rain, and a single individual was discovered hopping along the concrete of the beach road in Biloxi on a dry night in July.

Bufo fowleri Garman.—An examination of about 350 toads has resulted in the discovery of two specimens referable to this species. I do not recall having heard the voice of this toad at any time. Its occurrence in this region is certainly beyond dispute, but it must be very rare.

Bufo terrestris Bonnaterre.—These toads are very common and can be collected at practically any time of the year. Midday heat forces them to take advantage of the shade of various farm buildings or the retreat of log or stump, but dusk finds them hopping about the fields and roadways. On warm, rainy nights they come forth in numbers and their predilection for the paved highway causes a reduction in their numbers.

The first week of March, 1931, was unusually warm and attended by abundant rain. At this time breeding toads were very numerous in flooded meadows, ditches and ponds. Their voices were incessant day and night until the rain ceased and cold weather set in. At no other time has this species been observed to breed.

Four very large specimens were taken on Cat Island, February 19, 1930. Two were found along the beach beneath a board under which they had burrowed so far into the sand that only their snouts were exposed. The other two were discovered farther inland in the grass.

Bufo quercicus Holbrook.—For over a year and a half this species seemed to be totally absent from the fauna. Search was finally rewarded

however, and my notes dated June 8, 1931 read thus: three miles north of Biloxi, six found in a small, wet depression near a pond; later several more discovered in the grass about the margin of another pool, on the surface of which were to be seen small patches of eggs; each egg separate but congregated with its fellows into groups; egg 1 mm. in diameter, capsule 4 to 5 mm.; the greater number in the neural groove stage with a few in cleavage. These were brought to the laboratory and the development observed to be rapid, but none of the tadpoles lived to grow beyond a length of 10 mm.

A month later heavy rains filled the pools in the swamps and the oak toads became numerous but were perceptible for only a short time, for when the rains ceased they disappeared.

Acris gryllus (LeConte).—The cricket-frog is the commonest amphibian in this region. They abound in the shaded swamps and exhibit a preference for grassy areas and piles of debris about the margins of pools. On the coldest days they can be found leaping about erratically.

Pseudacris nigrita (LeConte).—This species has been found to be abundant through the winter and early spring, but what becomes of it during the summer remains a problem. Even on chilly nights they may be heard calling from the wet grasslands, rain-water pools and roadside ditches, but on warmer evenings, especially in rainy weather, the volume of their voices is much augmented. Because of their propensity for hiding in clumps of grass half submerged in the water these frogs are difficult to collect in numbers.

Several pairs were taken in copulation on December 15, 1929, and forty-two breeding pairs and some clumps of eggs were secured in daylight on January 20, 1931.

Pseudacris ornata (Holbrook).—Not a common species. It is encountered only in the winter and spring. Dickerson, in the 'Frog Book' (p. 161) says, "this frog is said to live on land, in relatively dry places, such as corn-fields. That it shuns bodies of water except during the breeding season might be judged from the smallness of the webs on its feet." It has been found in copulation in grassland pools in November and December and solitary individuals have been taken in similar habitats until February. Its call, a single high note much resembling that of *Hyla crucifer* but lacking the trill, has been heard on both warm and cold nights.

Pseudacris triseriata (WIED).—Six specimens taken in company with *P. nigrita*. Dr. G. K. Noble kindly examined a puzzling series of *Pseudacris* and from it selected four that seemed to be of this species. An examination of additional material by the author revealed two more.

It cannot be definitely stated that the voice of this species has been heard. Success has not accompanied efforts at tracing calls seeming to terminate in the characteristic crescendo.

Hyla cinerea cinerea (SCHNEIDER).—Very abundant. In the winter it hibernates beneath bark, in rotten stumps and logs, and in sawdust piles. As soon as the weather becomes warm and settled it may be found in the brackish coastal marshes. This type of summer habitat seems to be preferred because of the reeds and tall grass which it ascends at night to sing in a loud, monotonous chorus.

Specimens in captivity ate horseflies, damsel-flies and small butterflies and moths.

Hyla crucifer WIED.—Common in the winter and early spring. At night it sings from both the grassland pools and swamps. During the day it may occasionally be found under the bark of stumps situated in the swamps.

Hyla femoralis LATREILLE.—During the winter of 1929–1930, several specimens were taken from beneath the bark of stumps and logs and the following summer two or three were attracted by the insects about a sugary mass of sap. When the rains came in July, 1931, countless numbers appeared in the swamps but none was observed in copulation.

Hyla gratiosa LECONTE.—On the night of April 18, 1931, about five miles north of Biloxi, I became aware of a strange chorus of frogs. When they were finally traced and discovered to be of this species, it became apparent that they had first been heard at a distance of a mile and a half. Their combined voices at close quarters were almost deafening. The call consists of a single, harsh, guttural croak that might be compared to the bark of a dog or the sound produced by jerking through the closed fist a rosined string attached to an empty tin can.

The situation which they had chosen for their breeding was a large pond about three feet at its greatest depth, grassy about the edges and with many cypress and gum trees standing in the water. Seven specimens were taken from various objects near the shore and some distance out. The following night the pond was again visited and ten more specimens obtained.

During the rainy spell three months later a number of these frogs was found breeding in the swamps at widely separated localities.

Hyla squirella LATREILLE. —A common frog and probably more abundant than it appears for it is not easily seen on a limb or reed and, during the spring and summer, that is where they are found most frequently. This habitat indicates their association during this season with *Hyla c. cinerea.* They hibernate beneath the bark of pine stumps and logs but are seldom taken in the winter even from these situations.

On February 19, 1930, a specimen was taken on Cat Island from a pine stump and on March 12, four were found on Horn Island in a similar situation.

Hyla versicolor versicolor (LECONTE).—This tree frog is commonly found at all seasons. Winter usually finds them concealed within some decayed stump or log but after they have congregated about the pools in the spring and have dispersed, they may be seen occasionally upon the low vegetation in the swamps.

Several specimens were taken from a cavity in an oak tree about seven feet from the ground during the month of January, 1931.

Rana æsopus (COPE).—This species has been abundantly found throughout the months of October, November, and December in the burrows made by *Gopherus polyphemus.* When the temperature rises, these frogs become active and may be seen sitting in the openings of the tunnels down which they disappear at the least indication of danger. In colder weather they are never at the surface and can only be taken by digging to the bottom of the gopher hole, where never more than one is found in company of one or two turtles.

The only specimen taken near the coast was found in a pool of water on January 25, 1931. Ten or twenty miles inland gopher holes are numerous and it is in this region that this frog has been found in quantity.

Rana catesbeiana SHAW. —Although undoubtedly abundant in this region, the bullfrog is not taken in great numbers. The very large individuals are less often secured than the medium and smaller sizes. They have an obvious preference for small streams during the spring and summer and eggs have been found in such places in early May. Drain pipes seem to be a favorite place of concealment during cold weather.

Rana clamitans Latreille.—The green frog is encountered very frequently and is found in practically any suitable situation. During the warmer periods of winter and throughout the summer, they have been seen in the swamps, grasslands and small streams. In December and January, 1929–1930, several medium-sized specimens were dipped from a deep spring. An immature example kept in captivity fed on grasshopper nymphs (*Rhomælia microptera*), horseflies, butterflies and moths. It never swallowed the latter, however, always pushing them out of its mouth with its forefeet.

Rana sphenocephala (Cope).—A common frog, and to be collected throughout the year. It breeds in February but has been known to begin this activity in December.

An examination of several hundred frogs leads to the conclusion that the majority of specimens agree with descriptions of *R. sphenocephala* with a few exhibiting tendencies toward intergradation, and a small percentage having some of the characters of *Rana pipiens*.

Rana grylio Stejneger.—The southern bullfrog is a pond-inhabiting species, locally called "lake frog." During the month of April, 1931, this species was found on Point aux Chenes, Jackson County, in a vast fresh-water marsh that is separated from the sea by a narrow ridge. At dusk they start calling and their voices closely resemble a series of grunts.

This frog was also discovered in the pond described under *Hyla gratiosa*.

Rana grylio emits an unmistakable dank, musty odor when captured or handled and a slime that is bitter to the taste.

The two species *R. grylio* and *R. catesbeiana* have never been found in company.

Rana heckscheri Wright.—The range of this form as previously known was limited to the coastal regions of Georgia and Florida. Its capture at Biloxi extends its range considerably to the west.

On September 12, 1931, the rivers and creeks were swollen and out of their banks from the heavy rains that had been falling. Cypress Creek, about two and a half miles north of Biloxi, covered the road and the bridge spanning it to a depth of from two to four feet. In this overflow the large, conspicuous tadpoles were very abundant. After the waters had receded more specimens were taken from a small pool left by the falling stream. Some time later specimens of about 40 mm. in length with the tail absorbed and the legs well developed were taken

from ponds and ditches located in the once flooded area between Cypress Creek and the Tchoutacabouffa (Tchula Cabawfa) River.

The unusual feature of these captures is the fact that never before have these amphibians been seen in this region. The very ponds and ditches from which they were taken had been seined many times and with no other result than the securing of bullfrog tadpoles. The ensuing month witnessed the capture of the last specimens and since then none has been seen. Cypress Creek is deep, narrow and filled with snags and the banks are thickly covered with tangled vegetation, all of which make seining an impossibility. In the depths of this and other similar streams the tadpoles live, no doubt, and because of these conditions they succeed in remaining concealed from sight until the rising waters swirl them to the surface.

Little is known concerning the habitat of the adult frog in this region. One mature example has been taken. On March 18, 1930, it was discovered in full daylight sitting on the bank of a small stream in the middle of a swamp. It was not at all timid and a noose was easily slipped over its head. At that time I was unacquainted with *heckscheri* and the puzzling specimen was doubtfully referred to *catesbeiana*.

The specimen measures 150 mm. from snout to anus. The back is tuberculate and with the tubercules more or less regularly disposed. Along the side they become slightly elongated and connected to form two rows 4 mm. apart extending from the fold behind the ear to the insertion of the femur. The dorsal surface is a medium dark brown. There are spots on the lower jaw and disconnected markings on the femur.

Gastrophryne carolinensis (Holbrook).—This frog is common but is difficult to find except by a diligent search. During the winter and summer, specimens may be discovered beneath logs, in and near swamps, and other moist places. On a summer night their shrill buzzing from the swamps serves as a guide to their location and capture, but even when only a few feet away they are difficult to find, for they usually sit in the mouths of their burrows or are hidden in clumps of grass.

Part II.—REPTILIA

Loricata

Alligator mississipiensis (Daudin).—The alligator, despite the avidity with which it is hunted, is still to be found in comparatively large numbers. Their dens, to which they retire during the colder months, are found in the coastal marshes, rivers, lagoons, and swamps.

Several specimens have been seen swimming in the bay of Biloxi and an individual a little over six feet in length was taken with a cast net from the waters of the bay.

On the afternoon of August 4, 1931, Mr. Springer and I discovered on the north shore of Biloxi Bay a nest containing twenty-five eggs. It was constructed of reeds, grass, and small sticks, and was built around two small bushes situated about twenty feet from the edge of a brackish marsh. A well-worn trail from the nest to the marsh gave the clue to its presence. In a remote and unfrequented place, there was slight chance of its discovery by a casual observer.

SQUAMATA

Anolis carolinensis Voigt.—A very abundant lizard. Hibernates under logs and in rotten stumps. Common on the ground and in trees in the swamps and pine forests during the summer.

Sceloporus spinosus floridanus (Baird).—One specimen found about three miles west of Biloxi on March 9, 1930.

Sceloporus undulatus undulatus (Latreille).—Abundantly seen in the pine forests whenever the temperature permits reptilian activity.

Ophisaurus ventralis (Linné).—Commonly taken throughout the summer in wet, grassy places.

On a cold day in January a specimen was found about a foot beneath the surface of the ground near the base of a stump. It was quite dormant but soon exhibited signs of life when placed near a fire.

An example was taken from Horn Island, March 29, 1930.

Cnemidophorus sexlineatus sexlineatus (Linné).—These lizards are never seen in the winter and do not come forth from hibernation until April, when the temperature is usually warm and settled. They are abundant in the pine forests and are frequently seen in sandy roadways.

They are very common on Horn Island, where they prefer the sandy situations about palmetto clumps, in the thickest parts of which they make their holes.

Leiolopisma laterale (Say).—Very common on the forest floor during the warmer parts of the year. Hibernates in old logs and stumps.

Eumeces fasciatus (Linné).—While this species is abundant it usually remains concealed under bark and logs throughout the entire year.

Large specimens have been taken on the coast but no red-heads have been seen. Twenty and more miles inland this color phase has been found.

SERPENTES

Farancia abacura (HOLBROOK).—Undoubtedly common but only three specimens have been secured. Two of these were taken in daylight: one, May 15, 1931, on the bank of a stream and the other, April 15, 1931, while crossing a road. In July 1931, the third specimen was found. It was also taken on a road but was small and was secured at night.

Diadophis punctatus stictogenys COPE.—The ring-necked snake is commonly found during the entire year; the habitat, under the bark of stumps and logs, remains unchanged through the seasons.

Heterodon contortrix (LINNÉ).—A serpent that is frequently encountered throughout the summer and occasionally in the winter during the higher temperatures. Outbuildings and fields seem to be the favorite haunts of this species.

A large specimen of the black phase, which regurgitated two toads upon handling, was found in a barn in June, 1930. On November 30, 1929, a specimen was taken from the water about five hundred yards from the shore in the bay of Biloxi.

Heterodon simus (LINNÉ).—Much less common than the foregoing species. One small specimen found in a thick woods three miles north of Biloxi on July 15, 1931, and three examples in midsummer south of Vestry.

Opheodrys æstivus (LINNÉ).—The earliest record of capture is April 6, 1930. Later in the summer they are not infrequently observed in vines and bushes.

Coluber constrictor constrictor (LINNÉ).—A specimen of this snake was found in January with its head and several inches of its body protruding from a hole in a dry field. Other than this the hibernating habits of this species are not known. A few specimens have been taken in the open in February but they are not seen in abundance until the weather has become hot. At this time they are common in grassy fields and in upland woods.

Coluber flagellum flagellum (SHAW).—A few specimens have been found in the summer in the same type of habitat frequented by *C. c. constrictor*.

Elaphe guttata (Linné).—Corn-snakes are occasionally found at all seasons. They hibernate in hollow trees and rotten stumps and in the summer are generally distributed through the swamps and pine forests. Specimens of a foot in length are the most common, very large examples are rare and are taken only in the warmer months.

Elaphe obsoleta confinis (Baird and Girard) —This snake does not appear to be quite as common as the preceding species but is somewhat similar in habits. It seems to enjoy the shelter of farm buildings where, according to some farmers, it has been seen to catch mice. During the winter occasional specimens are to be discovered beneath bark and in hollow trees. On a warm day, February 4, 1930, one was taken from the top of a high stump.

Leimadophis flavilatus (Cope).—Three specimens of this species have been found. Two were discovered in March beneath the bark of pine stumps and the third one about a month later under a pile of straw in company of an *Ophisaurus ventralis.*

Lampropeltis elapsoides elapsoides (Holbrook).—Winter and spring are the seasons in which this species is occasionally found in the crevices and hollows beneath the bark of pine stumps and logs. During the winter of 1929–1930 about fifteen individuals were taken from these situations. The capture of a specimen on May 25 appears to be the latest record for this type of habitat. On a night in June a large female containing eggs was discovered crawling across a street on the outskirts of Biloxi and this is the only instance in which a specimen has been found in any situation other than the one described. What becomes of it during the summer remains unknown Large areas of stumps and logs have been worked over in this season with no success. The example of the capture in June might possibly indicate that with the advent of warm weather it assumes a roving disposition.

Captive specimens have readily eaten *Leiolopisma, Eumeces,* and *Potamophis,* while consistently refusing *Diadophis.*

Lampropeltis getulus holbrooki (Stejneger).—This species is common at all seasons and is usually found in the open pine woods and along the edges of swamps. A large example, discovered in the summer beneath a piece of tin, quickly disappeared down a hole upon removal of the shelter, but it was necessary to dig only about a foot to secure it. During the winter no large specimens have been seen, small ones alone

having been taken from under the bark of stumps and logs. It is not until spring that mature individuals make their appearance.

The transverse lines are present in practically all specimens.

Lampropeltis rhombomaculata (Holbrook).—A species not previously recorded west of Mobile, Alabama. Two adults were taken at different times in fields not far from stands of timber in April, 1931, and during the same month another specimen, in which life was almost extinct because of a blow that it had suffered on the head, was discovered on the highway. In September, 1930, an immature example was found under a log.

The color patterns of all four specimens were distinct.

Sex	Length	Gastrosteges	Urosteges	Oculars	Temporals	Scale Rows	Infralabials	Supralabials	No. Dorsal Blotches
Male	970	206	50	1–2	2–3–4	21–21–19	9–9	7–7	51
Male	1000	207	52	1–2	2–3–4	21–21–19	9–9	7–7	50
Female	244	206	37	1–2	2–3–4	21–21–19	8–8	7–7	68

Cemophora coccinea (Blumenbach).—Two specimens of this species have been found. One was discovered dead on a road July 9, 1931, and the second example was found under a piece of bark near a swamp December 10, 1931.

Natrix clarkii (Baird and Girard).—Found occasionally in the salt-water marshes during the summer.

On Horn Island, in a large, shallow pool surrounded by marsh-grass and abundantly supplied with water-snakes and alligators, this species is common.

Natrix cyclopion (Duméril and Bibron).—Very common in the swamps and brackish marshes. This species was also found in the pool mentioned above.

Natrix fasciata fasciata (Linné).—Rivals the preceding species in abundance and inhabits the same situations, though not found in such immediate proximity to salt water.

The body cavity of a large female was opened on August 11, 1931, and found to contain twenty-three well-developed young measuring 225 to 230 mm. in length.

Natrix fasciata confluens Blanchard.—Three examples taken at night from a pond during the month of July, 1931. They were found to associate with *N. cyclopion* and *N. f. fasciata* but not to intergrade with the latter.

Natrix rhombifera (Hallowell).—Occasionally found in thick swamps.

In July, 1931, a specimen was taken measuring five feet six and one-half inches. The stomach contained a large sunfish and a bullfrog of seven inches body length.

Natrix rigida (Say).—A small specimen was found under a board on the edge of a pond March 5, 1931, and the following month another, larger specimen was taken from a similar situation.

Natrix sipedon erythrogaster (Forster).—One specimen from the Pascagoula River, Jackson County, April 20, 1930.

Infralabials 10, gastrosteges 152, scale rows 23, length 35 inches. Color in formalin: head and dorsal surface of body uniform greenish black. Ventral side of head and body whitish.

Storeria dekayi (Holbrook).—A specimen found November 8, 1929, and another in the summer of 1930.

Storeria occipito-maculata (Storer).—Four specimens found under the bark of pine stumps: two in September and October, 1930, and two in the summer of the following year.

Virginia valeriæ elegans (Kennicott).—Occasionally found under logs throughout the year.

Potamophis striatulus (Linné).—On February 12, 1930, twenty specimens were taken from beneath the bark of pine stumps and logs within an area of one hundred square yards. Numbers were found congregated under the same piece of bark. Except for this single instance this species is found only occasionally beneath logs and in stumps.

Thamnophis proximus (Say).—A large example of this species was found in a marsh on Cat Island, February 19, 1930, and a smaller specimen was taken twelve miles south of Vestry near the Harrison-Jackson county-line on November 10, 1931.

	Sex	Length	Gastrosteges	Urosteges	Supralabials	Infralabials	Scale Rows	Tail Ratio	Dorsal Stripe
Cat Island	Female	1268	175	118	8–8	10–10	19–17	0.34	Present
Vestry	Female	519	154	110	8–8	10–10	19–17	0.30	Present

Thamnophis sauritus (Linné).—Found occasionally throughout the year on the coast and farther inland. It prefers wet meadows and the vicinity of ponds. Stomachs of several specimens contained *Acris* and *Pseudacris* and captive specimens readily ate these species of frogs.

Thamnophis sirtalis sirtalis (Linné).—This species has not been found on the coast. A specimen was taken twelve miles south of Vestry on September 10, 1931, and a month later an example of the *ordinatus* type was found in the same locality.

Tantilla coronata (Baird and Girard).—Several specimens taken during the winter months below the surface of the ground on the interior of pine stumps. An individual found beneath a log in July, 1931, and at about the same time another specimen under the bark of a stump.

Agkistrodon piscivorus (Lacépède).—This species is very common in the swamps. During the colder periods of winter they have been found in this habitat under logs and in stumps.

In the summer they are numerous about the margins of pools and while the majority will immediately take refuge in the water when disturbed, some will lie in a loose coil with the mouth opened to almost 180 degrees and rapidly vibrate the tail. When so disposed no amount of prodding can induce them to move. At this season they appear to be more active at night, crawling out upon the banks and about the roots of trees extending into the water. On one evening a large specimen was observed pushing about on the surface of the water a small, dead pike. It was evident from the wound on the belly of the fish that the moccasin was responsible for its death. At another time a medium-sized example was found on the bank swallowing a specimen of *Hyla gratiosa*.

In captivity specimens have eaten frogs, mice, birds, dead fish, pigmy rattlers and copperheads. Toads have been offered and even though the snakes had been without food for some time they were refused.

Sistrurus miliarius (Linné).—In winter this snake is not often secured, but during the summer captures are not infrequent. Specimens taken in the former season have been found under logs in the dryer sections of swamps and, while those captured in the warmer parts of the year were usually on the move, they were consistently seen in the vicinity of lowland streams and dense thickets.

Captive specimens have fed well on young white rats.

Crotalus species.—There have been no recent records of large rattlers on the coast but inhabitants twenty to thirty miles inland report that they are common. However, the author has been unsuccessful in securing a specimen. Even though the reports are no doubt true, it is impossible to determine from the descriptions whether they are *Crotalus adamanteus* or *Crotalus horridus.*

Testudinata

Due to the lack of extensive turtle collecting the following list is probably incomplete.

Sternotherus carinatus (Gray).—One specimen found near Biloxi in June, 1931.

Sternotherus odoratus (Latreille).—One specimen taken September 24, 1930.

Kinosternon subrubrum subrubrum (Lacépède).—The turtles are very abundant in ponds throughout the summer, and may on occasion be discovered in the winter in small pools in the swamps.

Chelydra serpentina (Linné).—A large specimen taken from an isolated pond in April, 1931, and several others of smaller size from sluggish streams and ponds during the summer.

Terrapene carolina triunguis (Agassiz).—This species has been commonly taken throughout the year in the meadows, but does not seem to be as numerous as the following.

Terrapene major (Agassiz).—This turtle seems to prefer the wooded swamps and is abundant at all seasons. In December, 1929, a pair was found a short distance down what appeared to be a burrow of *Gopherus polyphemus.* Several specimens kept in a shallow pool were frozen solid in the ice for about twenty-four hours but when thawed out seemed to be perfectly healthy.

In captivity they will eat practically any vegetable or animal matter and have been observed in copulation both winter and summer.

Malaclemys pileata pileata (WIED) —One small specimen and two adults were taken in the marshes about Biloxi during the summer of 1931. They are common along the east coast of the Louisiana Marsh and are caught in numbers in seines and trawl nets.

Graptemys pseudogeographica kohnii (BAUR).—One small specimen found in Pascagoula River, Jackson County, on July 20, 1930

Pseudemys alabamensis BAUR.—A large specimen was taken on hook and line from the Tchoutacabouffa River on October 22, 1929.

Pseudemys concinna (LECONTE).—A large individual was found on the landward beach of Horn Island, on June 28, 1930. It was very slow in its movements and seemed to be near death. It had probably been carried out to sea and become stranded on the island. The carapace and plastron of another fresh-water turtle was found nearby, but the species could not be determined with accuracy.

Several small specimens were found on the banks of lagoons along the Tchoutacabouffa River during the summer of 1931.

Deirochelys reticularia (LATREILLE).—A large specimen found in the woods near a stream about ten miles north of Biloxi in March, 1931. Others taken in the following summer and spring from ponds and swamps indicate that it is not a fluviatile species.

Gopherus polyphemus (DAUDIN).—Fifty specimens were brought in from twelve miles south of Vestry near the Harrison-Jackson county-line during the months of October and November, 1930. All were dug from their holes.

The burrows of these turtles, which averaged about seven feet deep, ran in at a slant, were enlarged at the termination, and situated on slopes. Two specimens were frequently found occupying the same hole.

Chelonia mydas (LINNÉ).—One small specimen taken in a trawl net near Breton Island, Louisiana, in March, 1931.

Caretta caretta (LINNÉ).—The loggerhead is frequently taken in trawls off the Mississippi coast, specimens of ten to sixty pounds having been seen. The fishermen report that they have secured turtles weighing as much as six hundred pounds. Specimens of this size are probably of the above species.

On moonlight nights in June these turtles have been seen on the seaward beaches of the outlying islands. Though I have failed in finding nests, the hunters say that at this time the reptiles lay their eggs.

Amyda ferox (Schneider).—No records for Harrison County but this species undoubtedly occurs here as soft-shell turtles have been seen and specimens taken in the adjoining Hancock County.

AMERICAN MUSEUM NOVITATES

Number 543 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | June 20, 1932

56.9:12 (8)

THE MOST ANCIENT EVIDENCES OF DISEASE AMONG SOUTH AMERICAN MAMMALS[1]

BY GEORGE GAYLORD SIMPSON

The work of Moodie in recent years has resulted in the recording by himself and others of numerous examples of disease in fossil vertebrates, but apparently none has been described among South American mammals previous to the Santa Cruz (Miocene). The three pathological specimens here briefly described are thus worthy of record, especially as one is of particularly unusual and interesting character.

MANDIBULAR NECROSIS IN *RHYPHODON*

In the La Plata Museum (Argentina) there is a pathological lower jaw catalogued as No. 12–1717 with the type skull of *Rhyphodon lankesteri* Roth and essentially a cotype of that species although probably not of the same individual as the skull. It was recorded by Roth as from the Cretaceous of Lago Musters, which probably means that it is from the *Astraponotus* beds near the place now called Pajarito, on the west side of the Cerro del Humo, in central Patagonia.

The necrosis affects the lower border and inner surface of the right ramus of the mandible from below M_2 to the posterior end of the symphysis. The whole lower border is here thickened to about one and one-half times its normal thickness and the surface of the bone above this is much roughened and shows two definite necrotic sinuses. Just below the posterior end of P_4 and anterior end of M_1 is a shallow, irregular pit about 17.5 mm. in diameter and with slightly raised edges. At its lower side, near the middle of the jaw, is the funnel-shaped opening of a passage running straight down into the interior of the diseased part of the jaw. A similar opening occurs near the alveolar border at the anterior root of P_4, this root being partly exposed by absorption of the bone. The right P_3 is missing and apparently was lost during life, perhaps as a result of alveolar osteitis, although the dental border is not here otherwise strongly affected by the infection. P_4 is much more deeply and irregularly worn on this side than on the other, probably as a result of malocclusion following the loss of P_3 and only indirectly due to the pathological condition.

[1]Publications of the Scarritt Patagonian Expedition, No. 4.

The outer side of this ramus and all of the symphysis and of the other ramus are quite normal.

The case is clearly one of extensive chronic infection. The history of the necrosis is, of course, conjectural. It is very unlikely that it followed an injury, because of the localization of the infection on the inner side of the jaw and the lack of any direct evidence of such injury. It is quite possible that the disease set in as alveolar osteitis and that infection then spread along the inner surface of the jaw and to its lower border.

Fig. 1. *Rhyphodon lankesteri* Roth. Cotype, Museo de La Plata No. 12-1717. Internal view of right lower jaw.

Note two necrotic sinuses, roughened surface, absence of P_3, and malocclusion of P_4. The breakage of M_3 is postmortem. Photograph by Dr. Angel Cabrera, retouched, one-half natural size.

TWO CASES OF SPONDYLITIS DEFORMANS

Moodie has shown that lesions best classified as the results of spondylitis deformans are among the commonest evidences of disease among fossil vertebrates. The Scarritt Patagonian Expedition found two specimens of Eocene age which show typical conditions of this nature. Both specimens are from the *Notostylops* beds, Amer. Mus. No. 28446 an isolated specimen probably of *Thomashuxleya* sp. from Cañadón Hondo, east of the Río Chico near Paso Niemann, and Amer. Mus. No. 28447 associated with a skull of *Thomashuxleya* from Cañadón Vaca, west of the Río Chico near Paso Niemann.

The pathological vertebra of Amer. Mus. No. 28447 is a single dorsal. Its articular faces and neural arch are apparently normal, but the lateral and ventral surfaces of the centrum show lesions closely similar to those

Fig. 2.—*Thomashuxleya* sp. Amer. Mus. No. 28447, diseased dorsal vertebra. Posterior view. Two-thirds natural size.

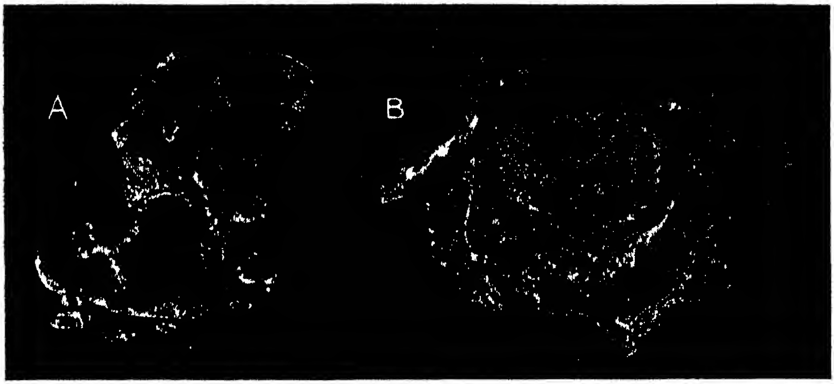


Fig. 3. *Thomashuxleya* sp. Amer. Mus. No. 28446, two coalesced diseased vertebræ.

A, right lateral view, showing deep, lipped capitular facet, fused zygapophyses, etc. B, anterior view, showing strong ventral exostosis. Two-thirds natural size.

of spondylitis deformans in man and other vertebrates. The exostosis is rather symmetrically developed. On each side the diameter of the centrum is increased by about 5 mm. minimum, and wing-like or lipping

processes extend outward along the anterior and posterior margins, but not in such a way as to clasp the adjoining centra. The space between these on the ventral surface, about 15 mm., is nearly normal posteriorly, but anteriorly there is a strong, blunt process imperfectly differentiated from the more wing-like processes on each side of it. Marked as it is, the lesion is not one which would in itself seriously impede the mechanical operation of the vertebral column, although of course the general pathological conditon accompanying it probably did so.

Amer. Mus. No. 28446 is a much more advanced and very severe case. The specimen consists of two dorsal vertebræ which are completely fused. Except in the floor of the neural canal, even the line of junction of the centra is obliterated, and the zygapophyses and base (at least) of the neural arches are also fusing, although not yet perfectly united when the animal died. The notch for the exit of the spinal nerve between the two vertebræ has been converted into a closed canal. The centra are surrounded by a large exostosis, extending in places over 15 mm. beyond the original surface, and very irregular in form. On the lower part there are large, irregular, blunt masses of bone with necrotic sinuses, and there are partly separate lipping extensions around the free articular surfaces, which were not definitely tending to fuse but on which movement must already have been much limited by these processes. Bony lips also surround the capitular facets, converting them into deep pits and apparently much impeding the motion of the corresponding ribs.

AMERICAN MUSEUM NOVITATES

Number 544 — Published by The American Museum of Natural History, New York City — June 20, 1932

55.2 (78)

THE LITHOLOGY OF SELECTED FOSSILIFEROUS TERTIARY SEDIMENTS

By Arthur D. Howard

INTRODUCTION

In the past few years the development of various techniques for the investigation of sedimentary rocks has made it possible to examine detrital deposits in more detail than formerly. Up to now very little work has been done on the lithology of the fossiliferous continental Tertiary sediments. It seems desirable at present to undertake such studies, since a knowledge of the character of the sediments adds to the information on the habitat of the fossil fauna and may also prove useful in the correlation of the continental Tertiary deposits.

The fourteen specimens described in the following pages were collected from eight well-known fossil localities (Fig. 1). They have been examined either in thin section or by gravity separation, the method employed depending on the degree of lithification of the rocks. Mechanical analyses were made of the specimens treated by the latter process. The procedure followed in the gravity method is that of Milner (1929, pp. 37–43). It involves a separation of the light and heavy minerals of the rock specimen. These minerals are then mounted in balsam and studied under the microscope. The light minerals are those having a specific gravity less than 2.72. The technique of the mechanical analyses is essentially that of Crook (1913, p. 5) and involves a determination of the percentage weight of mud, silt, sand, and "coarse" constituents. The percentage weight of calcite and other acid-soluble material is included in the results of the mechanical analyses.

In the section headed Conclusions, the results of the investigation are summarized and attempts are made to interpret the conditions of deposition of the various specimens examined.

The author wishes to acknowledge the generosity of the Department of Vertebrate Palæontology of The American Museum of Natural History in furnishing much of the material described in this paper. He is indebted to Curator Chester A. Reeds of the Department of Geology of that institution for editing and seeing the paper through publication.

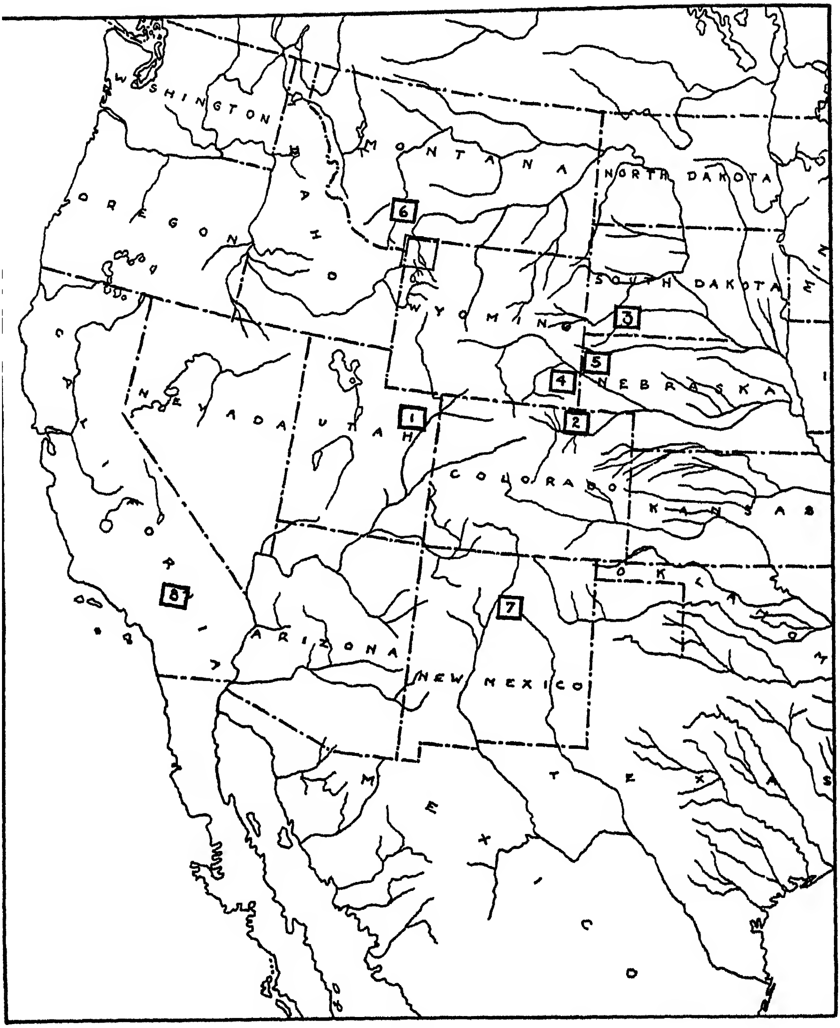


Fig. 1

LOCALITY MAP

	Specimen Number
1—Uinta Basin, Utah	1, 2, 3
2—Weld County, Colorado	4
3—Big Badlands, South Dakota	5, 6
4—Torrington, Wyoming	7
5—Agate, Nebraska	8
6—Madison Valley, Montana	9
7—Santa Fé Marls, New Mexico	10, 11, 12
8—Barstow, California	13, 14

Professors L. E. Spock and H. E. Wood of New York University offered much helpful criticism and advice in the preparation of the manuscript.

DESCRIPTION OF SPECIMENS

Specimen No. 1

Locality

A specimen from Horizon C of the Uinta formation near Ouray, Utah (Fig. 1). Donated by The American Museum of Natural History.

Hand Specimen

A brownish-gray, fine-grained, compact sandstone with a rough feel. Color uniform, texture homogeneous.

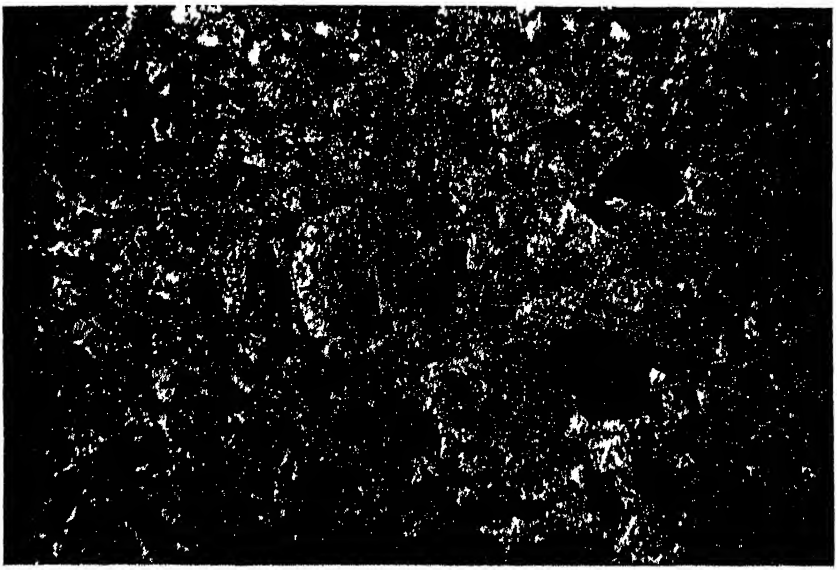


Fig. 2. Specimen 1. Ouray, Utah. The illustration shows sharply angular pyroclastic fragments embedded in a matrix of clay and calcite. The large, well-rounded quartz grain is of fluviatile origin. Chlorite (Chl), Glass (Gl), Magnetite (Mgt), Oligoclase (Olig), Orthoclase (Or), Quartz (Q), Titanite (Ti). Plane-polarized light, × 40.

Thin Section (Fig. 2)

The thin section shows clastic fragments embedded in a matrix of clay and calcite. Nearly all the fragments are angular, although some of the larger quartz grains are well rounded. The average size of the constituent fragments is 0.1 mm. A few quartz grains reach 0.3 mm., and biotite shreds up to 0.4 mm. are present.

Mineral constituents

Quartz—Abundant. Inclusions common, some liquid. A few grains show strain shadows. The larger grains are rounded.

Feldspar—Abundant. Oligoclase common, orthoclase rare. In various stages of decomposition.

Biotite—Common. Acicular shreds.

Hornblende—Common. Prismatic fragments.

Magnetite—Common. Small fragments.

Garnet and Titanite—Very rare. Small fragments.

Chlorite, Kaolin and Sericite—Abundant as secondary products.

Iron oxide—Nearly all the fragments are coated with ferric oxides.

Carbonaceous material (?)—Common.

Glass—Abundant. Altered. Some fragments shard-like in shape.

Special features

There are present in the section a series of light brown areas with hazy to sharply defined boundaries which occur up to 8.0 mm. in size. Johannsen (1914, p. 212) noted in one of his hand specimens from the Uinta formation the presence of "large dark brown inclusions," but found no evidence of these in his thin section. The areas are local concentrations of lime carbonate. Where the concentration is weak, the individual grains of the rock show through; where strong, the grains are not visible and have probably been entirely replaced by the lime carbonate. These areas are interpreted as incipient lime nodules.

PETROLOGY

The abundance of glass indicates a tuff. The mineralogy suggests derivation from crystalline rocks of intermediate composition.

CLASSIFICATION

A dacite tuff.

SPECIMEN No. 2

LOCALITY

Horizon C of the Uinta formation. Exact locality in the Uinta Basin unknown. (Fig. 1). Donated by The American Museum of Natural History.

HAND SPECIMEN

A coarse, arkosic sandstone of gray color, speckled with variously colored mineral grains. The specimen is well indurated. No apparent structure.

THIN SECTION

The grains vary from angular to rounded. The sorting is good. The cement is calcite and comprises probably 50 per cent. of the rock. The average size of the fragments is 0.5 mm., with some grains ranging up to 2.0 mm.

Mineral constituents

Quartz—Abundant. Inclusions common, often in linear arrangement. Strain shadows common.

Feldspar—Orthoclase and microcline abundant, albite common, oligoclase rather rare. Fresh and decomposed. A few of the orthoclase grains are twinned.

Muscovite—Rather rare. Occurs in irregular, short fragments.
Biotite—Rather rare. In shreds up to 0.35 mm.
Titanite and Garnet—Rather rare and smaller than average size.
Magnetite--Rather rare. Irregular grains.
Epidote—Rare. Small irregular grains.
Apatite—Rare. Small fragments.
Chlorite, Kaolin and Sericite—Common as alteration products.
Glass (?)—Rare. Spherulite fragments—Rare.

Lithic fragments.

Quartzite—Common.
Red-bed arkose—Rare.

PETROLOGY

The rock is a fluviatile sediment. The mineralogy suggests that several different kinds of rock furnished the materials of which the sediment is composed. It is probable that the most important contributor was a salic igneous rock. It is possible, however, that the material was derived from an earlier sediment of arkosic character. Some of the fragments appear to have come from a quartzite.

CLASSIFICATION

An arkosic sandstone.

SPECIMEN No. 3

LOCALITY

A specimen from Horizon C of the Uinta formation. Collected by Dr. H. E. Wood near Myton, Utah (Fig. 1).

HAND SPECIMEN

An earthy-gray, fine-grained sandstone. Weathers on the surface to a pale buff color. Indurated only in part so that the rock is somewhat friable. Contains small fragments of fossil bones. Disseminated specks of dark minerals.

THIN SECTION

Angular to subrounded clastic fragments in a matrix of clay and calcite. Grains of rather uniform size with an average diameter of 0.2 mm. A few fragments occur up to 0.8 mm. in size.

Mineral constituents

Quartz—Abundant. Inclusions and strain shadows common. Some fragments contain liquid inclusions.
Feldspar—Abundant. Oligoclase abundant; orthoclase, microcline, and albite fairly common. In various stages of decomposition.
Muscovite—Common. Flakes.
Biotite—Common. Iron-rich.
Garnet—Common. Small, irregular grains.
Magnetite—Common. Small, irregular grains.
Hornblende—Rather rare. Short, prismatic fragments.
Titanite—Rather rare. Small, irregular grains.
Tourmaline—Rather rare. Brown.
Chlorite, Sericite, and Kaolin—Common as secondary products.
Iron oxide—Common as coatings.

Glass—Abundant. Angular to subrounded fragments in various stages of alteration.

PETROLOGY

The relative abundance of angular glass fragments indicates that the rock is a tuff. The variety and character of the feldspar suggest derivation from igneous rocks of intermediate composition.

CLASSIFICATION

A dacite tuff.

SPECIMEN NO. 4

LOCALITY

A specimen from the lower Oligocene of Weld County, Colorado (Fig. 1). Collected by Dr. Florence D. Wood from the lower Trigonias quarry of the Colorado Museum.

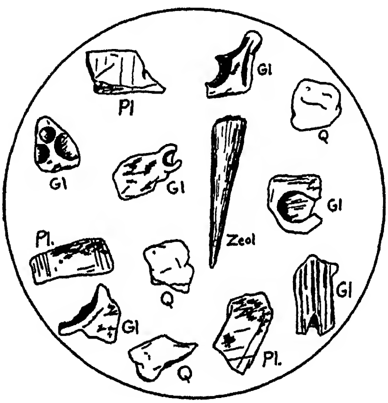


Fig. 3

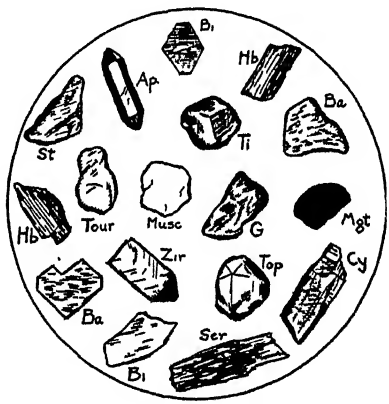


Fig. 4

Fig. 3. Specimen 4. Weld County, Colorado. Light crop. Note the crispness of the glass shards and the presence of contained cavities and capillary tubes. The angularity of the shards and the presence of a brittle zeolite fragment eliminate the possibility of working by water. Glass (Gl), Plagioclase (Pl), Quartz (Q), Zeolite (Zeol). Average size of fragments, 0.1 mm.

Fig. 4. Specimen 4. Weld County, Colorado. Heavy crop. The presence of crystal faces and sharply defined cleavage fragments is evidence of direct deposition from air. Apatite (Ap), Barite (Ba), Biotite (Bi), Cyanite (Cy), Garnet (G), Hornblende (Hb), Magnetite (Mgt), Muscovite (Musc), Serpentine (Ser), Staurolite (St), Titanite (Ti), Topaz (Top), Tourmaline (Tour), Zircon (Zir). Average size of fragments, 0.1 mm.

HAND SPECIMEN

A light-gray to white, fine-grained, friable rock without apparent internal structure. Under the hand lens, shows a few tiny specks of dark minerals.

MECHANICAL ANALYSIS (INCLUDING DETERMINATION OF CALCITE AND OTHER ACID-SOLUBLE MATERIAL)

Calcite, etc.	5.5 per cent.
Mud	13.0 per cent.
Silt	36.0 per cent.
Sand	43.0 per cent.
Coarse	Remainder

GRAVITY SEPARATION

Light crop (Fig. 3)

Glass—Very abundant. Shards coated with clay probably derived from the decomposition of the feldspar.

Quartz—Abundant. Inclusions fairly common.

Feldspar—Common. Various stages of alteration. Only oligoclase identified.

Zeolite—Rare. A cone-shaped fragment about 1.25 mm. in length. Resembles Pectolite.

Heavy Crop (Fig. 4)

Biotite—Very abundant. Sometimes red. Perfect hexagonal plates common.

Magnetite—Abundant. Crystal faces common.

Barite—Abundant. Cleavage fragments.

Hornblende—Abundant. Prismatic fragments.

Garnet—Common. Colorless to pink. Irregular fragments.

Titanite—Common. Crystal faces common. Irregular fragments.

Muscovite—Rather common. Basal flakes.

Zircon—Rather common. Elongated fragments and fractions of crystals.

Apatite—Rather rare. Euhedra and semirounded grains.

Topaz—Rather rare. Irregular grains and a fraction of a crystal.

Cyanite—Rare. Elongated cleavage fragment.

Tourmaline—Rare. Brown. Semirounded fragment.

Staurolite—Rare. Irregular fragment.

Serpentine—Rare. Fibrous fragment.

PETROLOGY

The abundance of glass shards indicates a tuff. The fragments are angular to subrounded. The mineralogy is that of a dacite.

CLASSIFICATION

A dacite tuff.

SPECIMEN No. 5

LOCALITY

A specimen from the Turtle-Oreodon zone, or lower Nodular layer, of the Brule formation of Oligocene age. Collected by Dr. H. E. Wood about 2 miles south of Scenic in the Big Badlands, South Dakota (Fig. 1).

HAND SPECIMEN

An extremely fine-grained, light-colored, clay rock without apparent structure.

THIN SECTION

Under plane-polarized light the rock is seen to consist of distinct fragments, so that the original clastic character of the rock is apparent. How-

ever, the individual "grains" have been almost entirely replaced by carbonate material. With the nicols crossed the individuality of the separate fragments is lost and the rock appears to be a homogeneous mixture of calcite and clay. The average size of the primary grains is about 0.05 mm., although some exceed 1.0 mm. in diameter. Many of them show rounded outlines. A few extremely small grains of quartz, feldspar, biotite, and glass are scattered through the groundmass. Sericite and chlorite are common as secondary products, and the presence of iron oxide lends a reddish-brown color to the section. The original sediment was apparently a fine-grained siltstone, but the replacement by calcite is almost complete.

CLASSIFICATION

A sedimentary clay rock containing minor amounts of volcanic glass.

SPECIMEN No. 6

LOCALITY

A specimen from the upper Nodular layer (75 to 100 feet higher than the preceding) of the Brule formation, Oligocene. Collected by Mr. E. J. Schlaikjer from the White River beds of South Dakota (Fig. 1).

HAND SPECIMEN

A grayish-white, dense, structureless clay rock. Under the hand lens shows a few small, isolated mineral grains.

THIN SECTION

This rock is essentially the same in its general appearance as the preceding specimen, and has apparently passed through the same history. It differs from the preceding only in the absence of the reddish-brown iron-oxide tint, and in the presence of disseminated specks of an unknown black substance which may be carbonaceous. In addition, a few small needles of hornblende are present. That no glass was directly observed is not necessarily evidence of its absence. The presence of a few fragments of glass might easily be obscured by the clay and calcite.

CLASSIFICATION

A sedimentary clay rock.

SPECIMEN No. 7

LOCALITY

A specimen of Oligocene age collected by Mr. E. J. Schlaikjer at the Harvard fossil quarry, four and one half miles southwest of Torrington, Wyoming (Fig. 1).

HAND SPECIMEN

A grayish-white, indurated, clay rock showing a few minute dark grains. No apparent structure.

THIN SECTION (FIG. 5)

Sharply angular grains embedded in an extremely dense matrix of clay and calcite. The fragments, both glass and mineral, have an average size of about 0.03 mm. Quartz and hornblende grains occur up to 0.4 mm.

Mineral Constituents

Quartz—Abundant. Some of the fragments show strain shadows. Inclusions not very common.

Feldspar Abundant. Oligoclase abundant; albite common. Fragments in various stages of decomposition. Inclusions common.
Hornblende Common. Prismatic fragments.
Biotite Rather common. Shreds.
Titanite Rare. Small irregular grains.
Chlorite, Sericite and Kaolin Common as secondary products.
Glass—Extremely abundant. Highly angular fragments. The shards are very small, having an average size of 0.03 mm. Some, however, occur up to 0.25 mm.

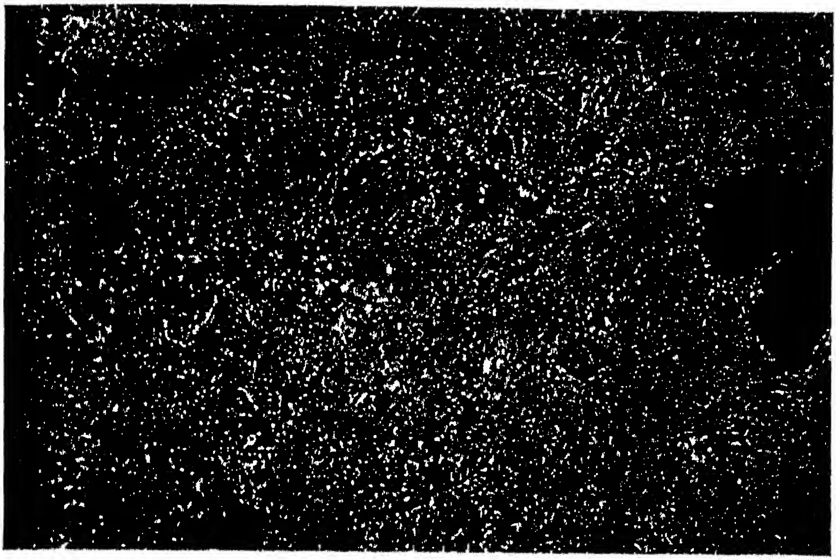


Fig. 5. Specimen 7. Torrington, Wyoming. The illustration shows abundant glass and pyroclastic mineral fragments in a matrix of clay and calcite. The angularity of the shards indicates direct deposition from air and no subsequent working by water. Glass (Gl), Oligoclase (Olig), Quartz (Q), Titanite (Ti). The dark blotches at the right are iron oxide stains. Average size of fragments, 0.03 mm. Plane polarized light, ×230.

Petrology

The abundance of shards indicates a tuff. The mineral suite is suggestive of an igneous rock of intermediate composition.

Classification

A dacite tuff.

Specimen No. 8

Locality

A specimen from the lower Harrison formation (lower Miocene) at the Agate Fossil Quarry, Sioux County, Nebraska (Fig. 1).

Hand Specimen

A light-gray to white, friable sandstone. Abundant dark minerals are visible under the hand lens. No apparent structure.

Mechanical Analysis (Including Determination of Calcite and Other Acid-soluble Material).

Calcite, etc.	40 per cent.
Mud	1 per cent.
Silt	2 per cent.
Sand	57 per cent.
Coarse	Negligible

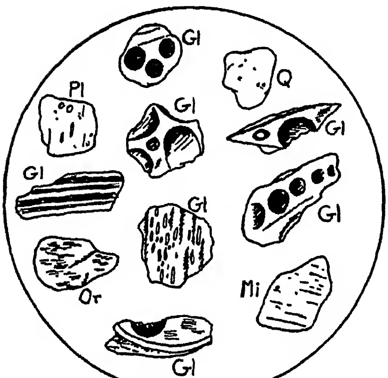


Fig. 6

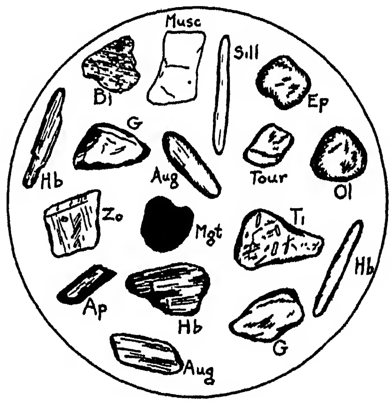


Fig. 7

Fig. 6. Specimen 8. Agate, Nebraska. Light crop. Note the abundance of glass shards showing cavities and capillary tubes and in one instance a parallel arrangement of liquid inclusions. Glass (Gl), Microcline (Mi), Orthoclase (Or), Plagioclase (Pl), Quartz (Q). Average size of fragments, 0.1 mm.

Fig. 7. Specimen 8. Agate, Nebraska. Heavy crop. The presence of chemically unstable olivine, augite, and apatite, rather distant from the nearest source of supply, is evidence for direct deposition from air. Apatite (Ap), Augite (Aug), Biotite (Bi), Epidote (Ep), Garnet (G), Hornblende (Hb), Magnetite (Mgt), Muscovite (Musc), Olivine (Ol), Sillimanite (Sill), Titanite (Ti), Tourmaline (Tour), Zoisite (Zo). Average size of fragments, 0.1 mm.

Gravity Separation

Light Crop (Fig. 6)

Glass (salic)—Extremely abundant. Highly angular to slightly rounded. Some of the shards show spherulitic cavities and capillary tubes; others contain liquid inclusions of comparatively large size.

Quartz—Abundant. Liquid inclusions common.

Feldspar—Abundant. Orthoclase, microcline, albite and oligoclase in equal amounts. Fresh to only slightly altered. Inclusions rather common in the plagioclases.

Heavy Crop (Fig. 7)

Hornblende – Very abundant. Long, slender fragments with rounded extremities.

Garnet—Very abundant. Pink and colorless.

Biotite—Common. Basal flakes.

Magnetite—Common. Fairly well-rounded grains.

Augite—Rather common. Prismatic fragments.

Muscovite—Rather rare. Basal flakes.

Sillimanite—Rather rare. Long prismatic fragments with rounded extremities.

Tourmaline—Rare. Deep blue (indicolite) and brown.

Epidote—Rare. Rounded grains.

Titanite—Rare. Subrounded grains. Abundant and large inclusions.

Olivine—Rare. Rounded.

Apatite—Rare. Portion of euhedron.

Zoisite—Rare. Cleavage fragment.

PETROLOGY

The mechanical analysis shows 57 per cent. of the rock to be composed of fragments of sand grade while 40 per cent. is calcite matrix. The texture is therefore that of a sandstone. Hornblende and sillimanite fragments occur two to three times the size of the other fragments. The mineral grains are imperfectly to perfectly rounded. The mineral suite suggests derivation from salic rocks in part metamorphic, as indicated by the elongated fragments of sillimanite and hornblende The specimen is obviously a tuff from the abundance of glass shards.

CLASSIFICATION

A dacite tuff.

SPECIMEN NO. 9

LOCALITY

A specimen from the Neogene deposits of Madison Valley, Montana. Either upper Miocene or lower Pliocene in age (Fig. 1). Donated by The American Museum of Natural History.

HAND SPECIMEN

A gray, rather firmly indurated sandstone with intercalated seams of fine gravel. Dark minerals appear somewhat abundant.

THIN SECTION (FIG. 8)

The section shows sharply angular fragments embedded in a coarsely crystalline calcite matrix. The calcite comprises probably 50 per cent. of the rock. The average size of the constituent fragments is about 0.25 mm., with some biotite shreds up to 0.55 mm. Glass is extremely abundant.

Mineral constituents

Quartz—Abundant. Inclusions and strain shadows common. The inclusions often show a linear arrangement.

Feldspar—Very abundant. Oligoclase abundant; orthoclase, albite common; microcline rare. Fresh to decomposed.

Hornblende—Rather common. Elongated fragments.

Biotite—Rather common. Shreds.

Muscovite – Rather rare. Shreds.

Garnet, Titanite and Magnetite—Rare. Small, irregular grains.

Kaolin and Sericite—Common as alteration products of the feldspars.

Glass (femic)—Shards very abundant. The average size of the glass fragments is 0.25 mm.; the maximum size, 0.5 mm

Lithic fragments

Fine sandstone—Rare.

Fig 8. Specimen 9. Madison Valley, Montana. The illustration shows highly angular pyroclastic constituents in a coarsely crystalline calcite matrix. Note the abundance and the angularity of the glass shards. Albite (Ab), Glass (Gl), Hornblende (Hb), Oligoclase (Olig), Orthoclase (Or), Quartz (Q), Titanite, (Ti). Average size of fragments, 0.25 mm. Plane polarized light, × 108.

PETROLOGY

The abundance of shards indicates a tuff. The mineral suite suggests an igneous rock of intermediate composition. The refractive index and the brown color of the glass are indicative of a femic composition.

CLASSIFICATION

A dacite tuff.

SPECIMEN No. 10

LOCALITY

A specimen of Neogene age from the Santa Fé Marls; upper Miocene or lower Pliocene. Collected by Mr. Childs Frick of The American Museum of Natural History, near Espanola, New Mexico (Fig. 1).

HAND SPECIMEN

A brownish-gray, medium to fine-grained, rather compact sandstone, showing grains of quartz, feldspar, and abundant dark minerals.

THIN SECTION

Angular to subrounded grains embedded in a coarsely crystalline matrix which comprises 40 to 50 per cent. of the rock. The average grain size is 0.2 mm., with some grains up to 0.5 mm.

Mineral Constituents

Quartz -Abundant. Strain shadows fairly common. Both solid and liquid inclusions observed. Inclusions often in linear arrangement.

Feldspar--Abundant. Orthoclase and albite abundant; microcline common. Fresh to almost entirely decomposed.

Hornblende Common. Prismatic fragments.

Magnetite—Common. Small grains.

Titanite - Rather rare. Small grains.

Biotite - Rather rare. Shreds.

Muscovite Rare. Shreds.

Apatite -Rare. Small grains.

Corundum Very rare. Angular fragment.

Chlorite, Sericite, and Kaolin—Common as secondary products.

Glass (?) Rare. Some of the grains present are believed to be altered glass.

Lithic fragments

Arkosic siltstone and vein (?) quartz--Rather common.

PETROLOGY

The mineralogy of the rock, particularly the character of the feldspar, suggests derivation from salic igneous rocks. In addition, the presence of arkosic siltstone fragments, and fragments of glass (?) point toward partial derivation of material from sedimentary and volcanic rocks.

CLASSIFICATION

A fine-grained arkosic sandstone.

SPECIMEN NO. 11

LOCALITY

A specimen of Neogene age from the Santa Fé Marls. Upper Miocene or lower Pliocene. Collected by Mr. Childs Frick, near Espanola, New Mexico, in the same general locality as the preceding specimen. (Fig. 1).

HAND SPECIMEN

A light tan, fine-grained sandstone which weathers on the surface to a brown color. No apparent structure.

THIN SECTION (FIG. 9)

The average size of the constituent fragments is 0.15 mm. The larger fragments occur up to 0.6 mm. The material is poorly sorted. The fragments are angular to subrounded. The matrix is coarsely crystalline calcite and comprises probably 50 to 60 per cent. of the rock.

Mineral constituents

Quartz--Abundant. Inclusions and strain shadows common. Some of the inclusions are acicular, others are liquid. They are often in linear arrangement.

Feldspar—Abundant. Orthoclase and albite abundant; microcline common. Many of the grains are completely decomposed.
Hornblende—Common. Prismatic fragments.
Magnetite—Common. Small irregular grains.
Biotite—Rather rare. Shreds.
Titanite—Rather rare. Small irregular grains.
Muscovite—Rare. Shreds.
Olivine (?)—Rare. Irregular grains.
Tourmaline—Rare. Brown and blue.
Kaolin and Sericite—Abundant as alteration products of the feldspars.
Glass (?)—Rare. Fragments of brownish material which may be altered

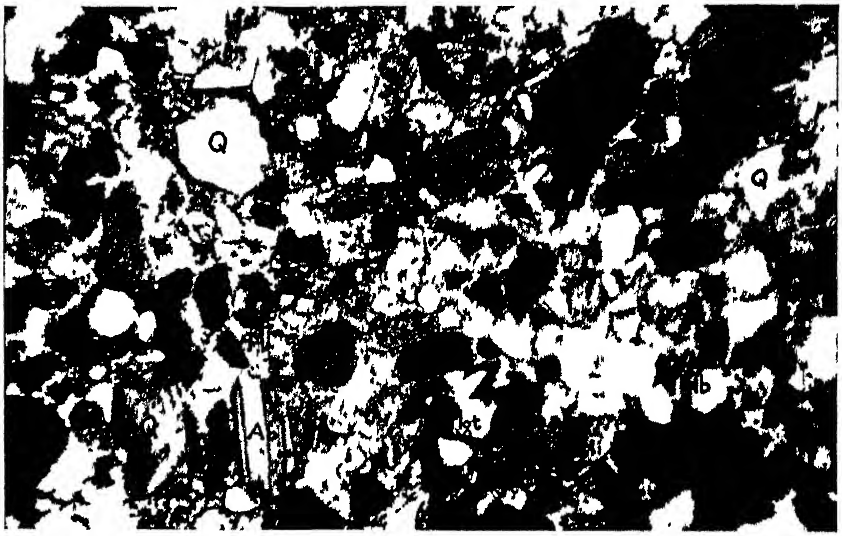


Fig. 9. Specimen 11. Espanola, New Mexico. Note the sharp angularity and the poor sorting of the mineral fragments. The cement is coarsely crystalline calcite. Albite (Ab), Hornblende (Hb), Magnetite (Mgt), Microcline (Mi), Orthoclase (Or), Quartz (Q). Crossed nicols, × 40.

Lithic fragments
Vein (?) quartz—Fragments of extremely fine-grained quartz which may represent vein material.

Petrology

Differs from the preceding specimen only in the slightly greater variation in grain size, and in the presence of tourmaline. The mineral suite suggests derivation from salic igneous rocks.

Classification

A fine-grained arkosic sandstone.

SPECIMEN No. 12

LOCALITY

A specimen of Neogene age from the Santa Fé Marls. Upper Miocene or lower Pliocene. From the same general locality as specimens 10 and 11 (Fig. 1).

HAND SPECIMEN

A grayish-white, fine-grained, friable sandstone showing a few dark minerals. Weathers on the surface to a dull, pale-buff color. No apparent structure.

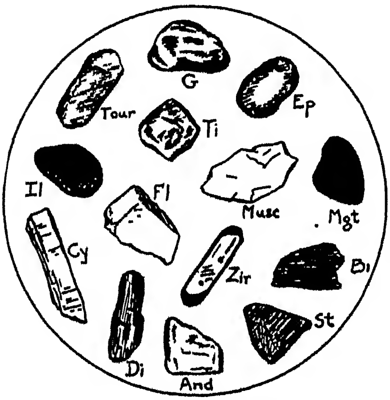


Fig. 10

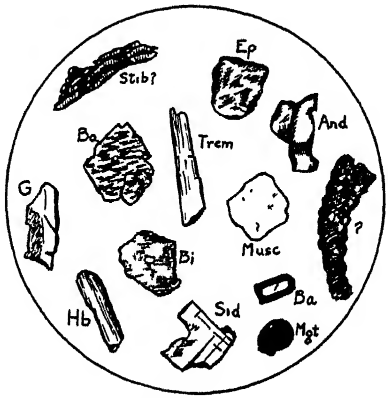


Fig. 11

Fig. 10. Specimen 12. Espanola, New Mexico. Heavy crop. The rounded character of some of the fragments is attributed to wind. Note the partial alteration of ilmenite to leucoxene. Andalusite (And), Biotite (Bi), Cyanite (Cy), Diopside (Di), Epidote (Ep), Fluorite (Fl), Garnet (G), Ilmenite (Il), Magnetite (Mgt), Muscovite (Musc), Staurolite (St), Titanite (Ti), Tourmaline (Tour), Zircon (Zir). Average size of fragments, 0.1 mm.

Fig. 11. Specimen 13. Barstow, California. Heavy crop. The fragments are angular although rather distant from the nearest source of material. Their size, however, is below the limit of water-rounding. Andalusite (And), Barite (Ba), Biotite (Bi), Epidote (Ep), Garnet (G), Hornblende (Hb), Magnetite (Mgt), Muscocovite (Musc), Siderite (Sid), Stibnite (Stib), Tremolite (Trem). Average size of fragments, 0.08 mm.

MECHANICAL ANALYSIS (INCLUDING DETERMINATION OF CALCITE AND OTHER ACID-SOLUBLE MATERIAL)

Calcite, etc.	1 per cent.
Mud	8 per cent.
Silt	13 per cent.
Sand	78 per cent.
Coarse	Negligible

Gravity Separation

Light Crop

Quartz—Abundant. Inclusions abundant, some liquid; a linear arrangement common.

Feldspar—Abundant. Orthoclase and microcline common; albite rather rare; oligoclase rare. Fresh and decomposed.

Vein (?) quartz—Rare. Dense, fine-grained quartz.

Heavy Crop (Fig. 10).

Muscovite—Abundant. Basal flakes.

Garnet—Abundant. Reddish-pink. Angular to rounded.

Epidote—Abundant. Well-rounded grains.

Magnetite—Abundant. Rounded grains.

Tourmaline—Reddish-brown, common; blue (indicolite), very rare.

Zircon—Common. Euhedra and fractions of euhedra.

Ilmenite—Rather common. Rounded grains. Partially altered to leucoxene.

Diopside—Rather common. Prismatic fragments.

Titanite—Rather rare. Slightly rounded grains.

Biotite—Rather rare. Some flakes almost red in color.

Fluorite—Rare. Octahedral cleavage fragments.

Andalusite—Very rare. Slightly rounded fragment.

Cyanite—Very rare. Bladed fragments.

Staurolite—Very rare. Slightly rounded fragment.

Petrology

The mechanical analysis shows 78 per cent. of the rock to be composed of particles of sand grade. The grains are angular to perfectly rounded. The mineral suite suggests derivation from salic igneous rocks in large part, and from highly aluminous metamorphic rocks to a lesser degree.

Classification

A fine-grained arkosic sandstone.

Specimen No. 13

Locality

A specimen from the upper Miocene or lower Pliocene (Neogene) beds near Barstow, California (Fig. 1). Collected by Mr. Childs Frick of The American Museum of Natural History.

Hand Specimen

A greenish-gray, friable clay rock locally discolored by iron oxide. Many slickensided surfaces occur as a result of tiny slip-faults within the rock.

Mechanical Analysis (Including Determination of Calcite and Other Acid-soluble Material).

Calcite, etc. .... 27 per cent.
Mud .... 26 per cent.
Silt .... 26 per cent.
Sand (?) .... 21 per cent.

The percentage of sand is very likely too high. The sand constituents appear to be fragments of highly indurated portions of the rock.

GRAVITY SEPARATION

Light Crop

Quartz—Abundant. Inclusions rather common.

Feldspar—The feldspars are so intensely altered that their exact identity is unknown. Two fragments of Oligoclase were identified.

Glass (?) There are present fragments of an unknown isotropic substance which may be glass. Rather rare.

Heavy Crop (Fig. 11).

Hornblende—Common. Prismatic fragments.

Magnetite—Common. Subrounded grains.

Garnet—Common. Irregular fragments.

Biotite—Common. Basal fragments.

Barite Common. Cleavage fragments and a fraction of a crystal.

Muscovite—Rather rare. Basal fragments of larger than average size.

Siderite Rather rare. Cleavage fragments.

Epidote—Rather rare. Subrounded fragments.

Stibnite (?) A lamellar, silver-gray mineral which closely resembles stibnite. Rather rare.

Tremolite Rare. Prismatic fragments.

Andalusite—Rare. Irregular fragment.

PETROLOGY

Seventy-nine per cent. of the rock is composed of fragments less than 0.1 mm. in diameter. The fragments are angular. The uncertainty of the species of feldspar present makes it impossible to say whether salic or femic rocks furnished the mineral constituents.

CLASSIFICATION

A sedimentary clay rock.

SPECIMEN No. 14

LOCALITY

A specimen from the upper Miocene or lower Pliocene (Neogene) beds near Barstow, California, collected from the same general locality as the preceding specimen. (Fig. 1).

HAND SPECIMEN

A greenish-gray, indurated, friable clay rock containing abundant bone fragments. Iron oxide stains are common. The specimen shows a platy, sheath-like structure due to tiny slip-faults. The slip-planes serve as water channels. Their surfaces are heavily coated by iron oxide.

MECHANICAL ANALYSIS (INCLUDING DETERMINATION OF CALCITE AND OTHER ACID-SOLUBLE MATERIAL)

Calcite, etc.	.51 per cent.
Mud	.17 per cent.
Silt	.15 per cent.
Sand	.17 per cent.

The percentage of sand is probably too high. The constituents appear to be highly indurated fragments of the rock.

GRAVITY SEPARATION

Light Crop

The character of the grains of the light crop is obscured by iron oxide and alteration products. The only mineral definitely determined is quartz. The quartz contains inclusions which are often in linear arrangement. No glass was observed.

Heavy Crop (Fig. 12).

The very abundant heavy residue is composed almost exclusively of clear, transparent, well-defined crystals of barite, some of which are doubly terminated. The crystals are elongated parallel to the "a" axis. The common forms are the pinacoid (001), the prism (110), the prism or macrodome (102), the prism or brachydome (011), and the rhombic bipyramid (111). The crystals appear to line the tiny fault surfaces within the sedi-

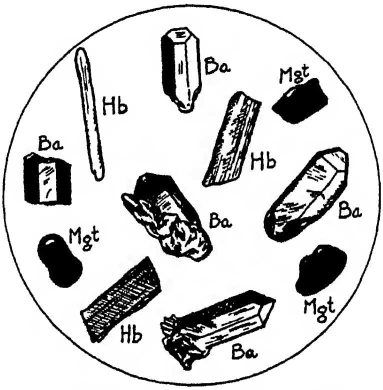


Fig. 12. Specimen 14. Barstow, California. Heavy crop. Note the clearly defined, authigenous barite crystals. Barite (Ba), Hornblende (Hb), Magnetite (Mgt). Average size of constituents, 0.1 mm.

ment and were probably formed in place through precipitation from barium-rich solutions. The barium itself may have been derived from other sediments in which it acted as the cementing medium; from massive deposits of barite; or from metalliferous veins. The remainder of the heavy crop consists of hornblende and magnetite. The hornblende occurs as prismatic fragments; the magnetite as small, subrounded grains.

PETROLOGY

The mechanical analysis shows 83 per cent. of the sediment to be composed of grains less than 0.1 mm. in size. The obscure character of the minerals of the light crop makes impossible a determination of the character of the source rocks.

CLASSIFICATION

A sedimentary clay rock.

CONCLUSIONS

EOCENE. UINTA BASIN, UTAH

Johannsen (1914, pp. 212 214) has described both hydroclastic and pyroclastic rocks from horizons A and B of the Uinta formation. The one specimen from horizon C which he described is a pyroclastic. Of the three specimens from horizon C analyzed in the present investigation, two are dacite tuffs, the third a fluviatile sediment. Consequently it seems that during Uinta time volcanic activity was intermittent in character. The pyroclastic constituents of the tuffs decrease in size from Myton to Ouray, that is, from west to east. It is probable, therefore, that the volcanic source was to the west.

The two specimens of tuff examined show no signs of working by water; the fragments are sharply angular. However, both contain occasional water-worn fragments which may have been introduced by adjacent rivers in times of flood. Those of the Ouray specimen are rather well-rounded (Fig. 2). The decreasing size and the increasing roundness of the fluviatile fragments from Myton to Ouray suggest that the direction of flow of the drainage between the two localities has remained unchanged. This is in keeping with the belief (Osborn, 1909, p. 21; 1929, p. 51)) that the drainage and general geographic setting of the mountain-basins have remained essentially unchanged since the middle Eocene.

LOWER OLIGOCENE. WELD COUNTY, COLORADO

The specimen from the lower Trigonias quarry at Weld County, Colorado, is a dacite tuff. The constituents of the rock, both mineral and glass, vary from sharply angular to slightly rounded. The clearly defined shards, the presence of crystal faces on many minerals, and sharply defined cleavage fragments, all rather distant from the nearest known source of supply, indicate volcanic derivation and direct deposition from the air, with little or no modification by running water. On the basis of the mineralogy, the source material would approximate a granodiorite in composition. Although this fossil quarry has been considered (Gregory and Cook, 1928, p. 3) the site of an ancient "mucky water-hole" because of the "absence of grit" and the "clearly-defined floor and abrupt margins" of the deposit, the analysis of the specimen examined in this investigation shows over 80 per cent. grit, indicating sandier conditions than previously supposed. The appearance of the material is misleading. The decomposition of the feldspar has resulted in abundant clay products which coat the other constituents.

Nodular Layers, Oligocene. South Dakota

Both the lower and upper nodular layers are sedimentary clay rocks. The cement is calcite and has almost completely replaced the constituent fragments. The cryptocrystalline cement suggests precipitation from quiet water (Emmons, 1928, p. 740) such as one would find in this area, according to the description of Sinclair (1921) and Wanless (1922, p. 202) who pictured the region as one of low relief partly covered by shallow ponds. The small amount of volcanic glass in the middle and lower Oligocene of South Dakota is in contrast with the abundance of ash in the lower Oligocene of Weld County, Colorado, to the southwest.

Oligocene. Torrington, Wyoming

The specimen from the Torrington fossil quarry is a dacite tuff. The pyroclastic constituents are of small size, averaging only 0.03 mm. The Torrington horizon is probably of middle Oligocene age.[1] The abundance of ash at Torrington in contrast to its paucity in the middle Oligocene of South Dakota appears to place the volcanic center in the Rockies somewhere to the west or southwest. This may explain the still coarser pyroclastic material farther south in the lower Oligocene of Weld County, Colorado. The same inference as to the location of the volcanic center which supplied Nebraska with its ash deposits has been drawn by Barbour.

Miocene. Agate, Nebraska

The specimen from the Agate fossil quarry is a pure ash. No fluviatile material is recognized. The feldspar is unaltered. This suggests deposition in a dry climate. The precipitation of the cement, furthermore, must have been rapid enough to protect the feldspar from decomposition. Peterson (1906, pp. 493-4) mentions lamination in the quarry level. This, considered with the evidence for rapid precipitation of the cementing medium, appears to indicate that the Agate quarry was the site of a shallow pond. Evaporation, in a dry climate, would cause the calcium carbonate in solution to precipitate fairly rapidly.

The fragments are perfectly sorted and in general angular, although some of the heavy minerals are well-rounded. The sorting, the angularity, and the pyroclastic origin of the material point to deposition from the air. The occasional rounding may be due to slight working by wind before deposition. The presence of augite and olivine, both un-

[1]Mr. E. J. Schlaikjer—verbal communication.

stable minerals, so far from the nearest source of supply, is evidence against a fluviatile origin of the Agate deposit.

UPPER MIOCENE OR LOWER PLIOCENE, MADISON VALLEY, MONTANA

The specimen examined is a tuff composed of highly angular fragments. It is cemented by coarsely crystalline calcite. Emmons (1928, p. 740) found by experiment that calcium carbonate precipitates from quiet water as a fine powder, and from circulating water as a coarsely crystalline product. If this is a criterion, the cement in this specimen was precipitated from freely circulating groundwater. The decomposition of much of the feldspar may also indicate contact with acidulated groundwater. The pyroclastic constituents show no signs of water-working, yet the hand specimen shows intercalated seams of gravel. The gravel seams may represent the overflow products of an adjacent river. The pebbles occur up to 8.0 mm. in size. This suggests that the river current was fairly vigorous.

The large pyroclastic constituents point to a relatively close volcanic center. This is not surprising, since the area is so close to the Yellowstone Park region, believed by Rowe (1903, p. 6) to be a possible source of the material. The large size of the pebbles in the gravel seams is likewise indicative of the proximity of the source of these materials.

SANTA FÉ MARLS. ESPANOLA, NEW MEXICO

Three specimens of the Santa Fé Marls have been examined in the present investigation. The most friable one was investigated by the gravity separation method, the others by thin section. The two firm specimens contain angular to subrounded, poorly sorted fragments in a coarsely crystalline calcite matrix which comprises 40 to 60 per cent. of the rock. The feldspar occurs fresh and partially decomposed.

Johnson (1903) disproved the lacustrine theory of the origin of the Santa Fé Marls, by a careful study of the sediments, and concluded that these deposits are wholly the result of laterally confluent alluvial fans spreading out from the neighboring mountain ranges. The lithologic evidence is in agreement. The angular character of the fragments suggests proximity to the source of material. The poor sorting and the irregular bedding observed in one specimen, are both indicative of the fluctuating conditions governing such deposits. The friable specimen, on the other hand, contains sufficiently well-rounded and well-sorted fragments to be considered of eolian origin. The evidence for eolian deposition, and the occurrence of fresh feldspar in all three specimens examined, indicate deposition in a dry climate.

UPPER MIOCENE OR LOWER PLIOCENE, BARSTOW, CALIFORNIA

Two specimens from the Pliocene deposits near Barstow, California, have been examined. The fine texture of the fragments, and the decomposition of the feldspar, point to long transportation by water. The fragments have remained angular because below 0.1 mm. in size, generally considered the lowest limit of water rounding. No glass was identified.

This study, in addition to furnishing information concerning the individual specimens examined, serves to emphasize the large, although not exclusive, part played by volcanic activity in building up the western continental Tertiary deposits, and in preserving their extraordinary record of mammalian evolution.

BIBLIOGRAPHY

BARBOUR, E. H. 1896. 'The deposits of volcanic ash in Nebraska.' Pub. Nebraska Acad. Sci., V, Proceedings, 1894-5, pp. 12-17.

The thickest beds and coarsest ash occur in the southwestern counties.

CROOK, T. 1913. 'Appendix to Hatch and Rastall's Petrology of the Sedimentary Rocks.' London.

A description of the methods involved in a mechanical analysis of a sedimentary rock.

DAVIS, W. M. 1900. 'The fresh-water Tertiary formations of the Rocky Mountain region.' Proc. Amer. Acad. Arts and Sci., XXXV, pp. 346-373.

A general review of the question of great Tertiary fresh-water lakes and a discussion of the criteria for recognition of lacustrine deposits.

DOUGLASS, E. 1899. 'The Neocene lake beds of western Montana, and descriptions of some new vertebrates from the Loup Fork.' Univ. Montana, thesis.

Lake deposits occur in nearly every large valley in the mountain regions. A constant feature of these lake beds is the pure gray volcanic ash occupying one or more layers.

1903. 'New vertebrates from the Montana Tertiary.' Ann. Carnegie Mus., II, No. 2, pp. 145-200.

White River formation of Montana a marsh and shallow lake deposit. Contains much volcanic ash. The Loup Fork Miocene of Madison Valley mostly of stream valley origin.

EMMONS, R. C. 1928. 'The precipitation of calcium carbonate.' Journ. Geol., XXXVI, pp. 739-740.

The results of experiments to determine the conditions under which calcium carbonate will precipitate.

GREGORY, W. K., AND COOK, H. J. 1928. 'New material for the study of evolution, etc.' Proc. Col. Mus. Nat. Hist., VIII, No. 1, p. 3.

The site of the Trigonias quarry considered to have been a mucky water-hole in lower Oligocene time.

JOHANNSEN, A. 1914. 'Petrographic analysis of the Bridger, Washakie, etc.' Bull. Amer. Mus. Nat. Hist., XXXIII, pp. 209–222.

A great part of the Eocene deposits is volcanic. W. D. Matthew, in the introduction, expresses the belief that the lacustrine theory as to the origin of many of the Tertiary deposits is much over-emphasized.

JOHNSON, D. W. 1903. 'The geology of the Cerrillos Hills, New Mexico.' School of Mines Quarterly [Columbia Univ.], XXIV, Jan., No. 2; April, No. 3; July, No. 4; XXV, Nov., No. 1.

The Santa Fé Marls are the result of laterally confluent alluvial fans spreading out from the neighboring mountain ranges.

Johnson, W. D. 1902. 'The High Plains and their utilization.' U.S.G.S., 22d Ann. Rep't, Part 4, pp. 631–669.

The materials of the High Plains were spread by shifting, heavily laden streams from the mountains.

MATTHEW, W. D. 1899. 'Is the White River Tertiary an eolian formation?' Amer. Nat., XXXIII, pp. 403–408.

The palæontologic evidence is against the lake-basin hypothesis.

1901. 'Fossil mammals of the Tertiary of northeastern Colorado.' Mem. Amer. Mus. Nat. Hist., I, Part 7, pp. 356–368.

Includes a description of the stratigraphy of the Tertiary of northeastern Colorado. An eolian origin favored for a great part of the White River beds.

1924. 'Correlation of the Tertiary formations of the Great Plains.' Bull. Geol. Soc. Amer., XXXV, pp. 743–754.

MERRIAM, J. C. 1901. 'A contribution to the geology of the John Day Basin.' Bull. Dept. Geol., Univ. Calif., II, No. 9, pp. 269–314.

The Tertiary of the John Day Basin is largely composed of volcanic ash.

MERRILL, G. P. 1886. 'Notes on the composition of certain "Pliocene Sandstones" from Montana and Idaho.' Amer. Journ. Sci., XXXII, pp. 199–204.

Specimens of "Pliocene Sandstones" from parts of Montana and Idaho prove to be volcanic ash.

MILNER, H. B. 1929. 'Sedimentary Petrography.' Van Nostrand, New York, pp. 37–43.

A description of the technique involved in a gravity separation of the light and heavy minerals of rocks.

OSBORN, H. F. 1909. 'Cenozoic mammal horizons of western North America, etc.' U. S. Geol. Surv., Bull. 361, pp. 19–28.

A general discussion of the geologic and climatic history of the Tertiary.

1929. 'Titanotheres of ancient Wyoming, Dakota and Nebraska.' U. S. Geol. Surv., Mon. 55, I, pp. 51, 91–92.

A general treatment of the geologic, physiographic, climatic and faunal environmental conditions of the Eocene and lower Oligocene.

PETERSON, O. A. 1906. 'The Agate Spring fossil quarry.' Ann. Carnegie Mus., III, No. 4, pp. 487–494.

The quarry believed to have been the site of a small Miocene lake. The water-worn character of bones found in the sandstone forming the floor of the quarry is attributed to wave action.

ROWE, J. P. 1903. 'Some volcanic ash beds of Montana.' Bull. Univ. Montana, XVII, pp. 1–32.

The abundant occurrences of ash in Montana are attributed almost entirely to local causes. In Miocene time many fresh-water lakes existed in Montana.

SALISBURY, R. D. 1896. 'Volcanic ash in southwest Nebraska.' Science, N. S., IV, Dec. 4, pp. 816–817.

Additional occurrences of volcanic ash reported from three new localities in southwestern Nebraska. The stratification possibly due to deposition in lakes.

SINCLAIR, W. J. 1906. 'Volcanic ash in the Bridger beds of Wyoming.' Bull. Amer. Mus. Nat. Hist., XXII, pp. 273–280.

Rhyolite ash described from the Bridger beds. The greater portion of the deposits considered of lacustrine origin. (See, however, Johannsen, 1914, pp. 214-219.)

1909. 'The Washakie, a volcanic ash formation.' Bull. Amer. Mus. Nat. Hist., XXVI, pp. 25–27.

The Washakie rocks are andesitic tuffs. Since the Bridger deposits are rhyolitic, they are not correlatives, and the faunal correlation is at variance with the lithologic evidence. (See, however, Johannsen, 1914, pp. 214–219).

1921. 'The "Turtle-Oreodon Layer," etc.' Proc. Amer. Philos. Soc., LX, No. 3, pp. 456–466.

A description of the Turtle-Oreodon Layer and a reconstruction of the conditions under which it was deposited.

SINCLAIR, W. J., AND GRANGER, W. 1911. 'Eocene and Oligocene of the Wind River and Bighorn Basins.' Bull. Amer. Mus. Nat. Hist., XXX, pp. 83–117.

Includes a discussion of the significance of feldspars in sediments.

WANLESS, H. R. 1922. 'Lithology of the White River sediments of South Dakota.' Proc. Amer. Philos. Soc., LXI, No. 3, pp. 184 203.

The White River sediments are of floodplain origin. The materials were derived in large part from the Black Hills.

AMERICAN MUSEUM NOVITATES

Number 545 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | June 22, 1932

59.88, 6 M (85)

STUDIES OF PERUVIAN BIRDS. VI

THE FORMICARIAN GENERA *MYRMOBORUS* AND *MYRMECIZA* IN PERU

BY JOHN T. ZIMMER

The present paper forms a continuation of the series of systematic studies of Peruvian birds, of which five earlier numbers have been published.[1]

As before, I am greatly indebted to various other institutions which have generously loaned certain material for comparative study, as indicated in the text. In addition I am under obligations to Dr. C. E. Hellmayr for comparing certain specimens with examples in European museums, not immediately accessible to me, and for critical notes on these examples.

Myrmoborus leucophrys leucophrys (Tschudi)

P(ithys) leucophrys TSCHUDI, 1844, Arch. Naturg., X, (1), p. 278—Montaña de Vitoc, Río Tulumayo, Perú; ♂; Mus. Neuchâtel

A careful study has been made of over seventy skins of the present species from the Andean chain of Colombia, Ecuador, Perú, and Bolivia, and of more than ninety skins from other parts of South America. While I am unable to recognize more than the typical subspecies as occurring in any part of Perú, the circumstances of its distribution are unusual and the range outside of Perú appears to be less extensive than has been supposed.

In the first place, birds from eastern Colombia (presumably also the Mérida region of Venezuela) are recognizably distinct and should bear the name *M. l. erythrophrys* (Sclater). The males are not greatly different from those of typical *leucophrys* except that the gray of the occiput and nape is a degree paler and possibly also the gray of the upper and under sides of the body. The females, however, have the back less olivaceous and usually more rufescent, the top of the head decidedly clearer and more deeply rufescent (not so dull and brownish or olive-tinged on occiput and nape), and the forehead and superciliary stripe are more deeply colored and consequently less contrasted with the top of the

[1]American Museum Novitates 500, 509, 523, 524, and 538.

head; the spots on the upper wing-coverts are smaller less buffy, and often more sharply defined than in *leucophrys*.

Specimens from eastern Ecuador agree better with typical *leucophrys* than with *erythrophrys,* though they are somewhat intermediate. Throughout most of the range in Perú there is little variation and no evidence of subspecific division. One of two nearly topotypical males has the black feathers of the throat lightly tipped with gray, but the other does not. Since the same variation is shown in other parts of Perú, it is to be assumed that the feature is a more or less variable one in *leucophrys,* though it becomes more fixed in birds from farther eastward in Brazil, as will be shown later. None of the examples of *angustirostris* or *erythrophrys* has a grayish throat.

The birds from northern Bolivia are rather puzzling inasmuch as they are inclined to depart from the standards of typical *leucophrys* in a very definite direction. As will be described in detail below, there is a form inhabiting the Rio Madeira and western Matto Grosso, Brazil, in which the males have a decidedly grayish throat and a relatively pale gray ventral surface, while the females are pronouncedly rufescent brown above, with dark occiput and nape, and deep orange-ochraceous forehead and superciliaries. There is a male at hand from Reyes, Río Beni, Bolivia, which is very close to this form and a female from the "Lower Beni" which also appears to belong to it. A female from the Río Espíritu Santo is like the Beni female, but two males from the same locality are not so clearly marked. Other skins from the Río Chaparé, between the Río Espíritu Santo and Matto Grosso, are more like *leucophrys* with the exception of one female which is like the Beni female.

It seems evident, therefore, that this entire region is one of intermediacy without any clearly defined boundaries between the ranges of the Peruvian form on the west and the Rio Madeiran and Matto Grosso form on the northeast. For purposes of reference, however, the two birds from the Río Beni may be assigned to the new form described below, and the remainder to *leucophrys.* A large series from all parts of northern Bolivia undoubtedly would show clearer lines of demarcation than can be found at present.

In this extended distribution from the upper Río Suno in Ecuador to the Río Chaparé in Bolivia, the subspecies follows, with singular persistence, the upper level of the Humid Tropical Zone. In Ecuador the course is simple and easily defined as it occupies the upper reaches of the streams which flow from the eastern side of the Andes. In Perú, however, the lines appear more complicated unless one is familiar with the broken

course of the central range of the Andes in this country. From Zamora, Ecuador, the species passes into Perú near the Río Chinchipe and crosses the middle Marañón in this same region. Still keeping to the eastern side of the same mountain range, the form extends eastward to Moyobamba, and up the Huallaga Valley as far as the Tropical Zone forests go. At this point the species crosses to the upper Ucayali Valley and its tributaries where it occupies those places where the same zonal conditions are found. When these disappear in turn, the species once more apparently interrupts its range and crosses to the headwaters of the tributaries of the Madre de Dios and extends its distribution to the upper Yungas of Cochabamba on the Chimoré in Bolivia.

If these areas are carefully plotted on an accurate map, it will be seen that they follow a general southeastward trend from the Ecuadorian-Peruvian boundary and roughly mark the region in which the Amazonian tributaries leave the strictly Andean slopes or gorges. On the Amazonian plain, this subspecies is not found but is replaced there in Perú by *M. lugubris berlepschi*, of which more will be said later. The connection of *leucophrys* with the lower Tropical Zone of the Amazon is to be traced through northeastern Bolivia and the Rio Madeira by means of the new form described below.

Myrmoborus leucophrys griseigula, new subspecies

TYPE from Rosarinho, Lago Sampaio, Rio Madeira (left bank), Brazil. No. 282,105, American Museum of Natural History. Adult male collected July 12, 1930, by the Olalla brothers.

DIAGNOSIS. Similar to *M. l. angustirostris* of the Guianas and the Orinoco region of Venezuela, but males with the throat quite distinctly tipped with dark gray, more widely on the lower portion, forming a gradual transition between the blackish chin and the gray breast. Females more distinctly rufescent brown on the back (less olivaceous) than those of *angustirostris;* forehead and superciliaries deeper orange ochraceous; crown, occiput, and nape correspondingly darker and more rufescent in tone; wings and tail averaging more strongly rufescent brown; spots on upper wing-coverts averaging more deeply ochraceous and often of larger size.

RANGE. South bank of the Amazon in the neighborhood of the left bank of the Rio Madeira; southward along the left bank of the Madeira, apparently crossing to the right bank near Calamá and continuing up the Machados into western Matto Grosso; also continuing up the Beni into northern Bolivia apparently as far as Reyes.

DESCRIPTION OF TYPE. -Forehead, anterior part of crown, and the broad superciliaries (reaching to the nape) silvery white, with shafts finely darker; posterior crown feathers with dark gray tips which widen posteriorly, making the occiput and nape rather dusky Slate-Gray,[1] with only the bases of the feathers whitish; back

[1]Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature'

clear, dark Slate-Gray. Lores, auriculars, and malar region black; chin blackish; throat and sides of neck blackish with dark Slate-Gray tips and margins which give the area a bluish gray appearance that merges imperceptibly into the dark Slate-Gray of the breast and sides; belly and flanks paler, Dark Gull Gray. Wings blackish, with exposed areas and outer margins Slate-Gray; tail similar; upper wing-coverts with faint traces of pale gray tips; wing-lining grayish white. Bill and feet black (in dried skin). Wing, 71 mm.; tail, 45; exposed culmen, 16; culmen from base, 20.25; tarsus, 26.

Remarks.—Females have the forehead deep, tawny Xanthine Orange, the color passing over the eye in a broad superciliary stripe that becomes paler over the auriculars; crown, occiput, and nape Argus Brown, with orange-rufous shafts and whitish bases; back Brussels Brown to Raw Umber; lores and auriculars black; chin, malar region, throat, breast, and belly broadly white; sides of neck dark gray, or blackish with dark gray tips; sides of breast with broad brownish olive tips and gray subterminal areas, continuous with the gray of the sides of the neck and forming a sort of lateral border to the breast (occasional specimens have the sides of the neck black, the subterminal portions of certain feathers of the sides of the breast also blackish instead of gray, and the tips gray instead of olive); flanks brownish olive; under tail-coverts white or tinged with olive buff. Exposed portions of wings Argus Brown or Argus Brown x Auburn; upper wing-coverts (except the smallest ones on the radial margin which are uniform like the back) with very conspicuous, more or less triangular, spots of deep buff at the tips of the feathers; tail Auburn, with margins somewhat brighter. Bill and feet black (in dried skins). Wing, 63–70.25 mm.; tail, 39.25–44; exposed culmen, 14.25–16; culmen from base, 18–20; tarsus, 25–27.

The series of males measures: wing, 66–71 mm.; tail, 39–47; exposed culmen, 15–16.5; culmen from base, 19–21; tarsus, 21.5–27.

Records from the Rio Juruá and the Rio Purús, Brazil, may belong with this new form as may even those from the Javari, but in the absence of skins for comparison I am unable to make a positive statement to this effect. There are no records of the species from the right bank of the lower Madeira, and a record from the left bank of the Tapajoz (Itaituba) is not to be placed with *griseigula* without examination. A male at hand from Tucunaré, Rio Jamauchim, is intermediate between *griseigula* and *angustirostris*, having the gray tips of the throat very dark though not absent. A male from Arumatheua, Rio Tocantins, has the throat black as in *angustirostris;* a female from the same locality has the head pale as in *angustirostris* (though it is a little more rufescent and less ochraceous in tone), and the back paler than in *griseigula*. It is possible that

a still different form inhabits this region, but without more material I hesitate to recognize it.

A single male from Barão Melgaço, Matto Grosso, agrees with the males of *griseigula*, and I assume that records from Calamá, Marmellos, and Jamarysinho, upper Rio Madeira, should be assigned to the same form.

SPECIMENS EXAMINED

M. l. erythrophrys. COLOMBIA: Bogotá, 1 ♂, 1 ♀; Villavicencio, 3 ♂, 3 ♀; La Morelia, 3 ♂; Buena Vista, above Villavicencio, 5 ♂, 2 ♀; Florencia, 1 ♀.

M. l. leucophrys. ECUADOR: Río Suno, above Avila, 3 ♀; below San José, 1 ♂, 1 ♀; Zamora, 7 ♂, 2 ♀. PERÚ: Santa Rosa, "Lower" (=Middle) Marañón Valley, 1 ♂; Río Seco, west of Moyobamba, 4 ♂, 3 ♀; Moyobamba, 2 ♀[1]; Vista Alegre, 2 ♂[1]; Lagarto, upper Ucayali, 1 ♂; Santa Rosa, upper Ucayali, 5 ♂, 3 ♀; Puerto Bermúdez, Río Pichis, 1 ♂[1], 1 ♀[1]; Tulumayo, Junín, 2 ♂; Río Tavara, 3 ♂, 1 ♀; Candamo, 1 ♂, 1 ♀; Astillero, 1 ♂. BOLIVIA: Tres Arroyas, Río Espíritu Santo, 1 ♂, 1 ♀; mouth of the Río San Antonio, Río Chaparé, 1 ♂; Todos Santos, Río Chaparé, 3 ♀, 2 ♀[1].

M. l. griseigula. BRAZIL: Rosarinho, Rio Madeira, 12 ♂ (incl. type), 9 ♀; Santo Antonio de Guajará, 3 ♂, 3 ♀; Barão Melgaço, Matto Grosso, 1 ♂. BOLIVIA: Reyes, 1 ♂; lower Río Beni, 1 ♀.

M. l. subsp. ?. BRAZIL: Arumatheua, Rio Tocantins, 1 ♂, 1 ♀; Tucunaré, Rio Jamauchim, 1 ♂.

M. l. angustirostris. VENEZUELA: Río Cassiquiare, El Merey, 2 ♂, 1 ♀; opposite El Merey, 15 ♂, 8 ♀; Caño Durutomoni, 1 ♂, 2 ♀; 8 miles above Río Orinoco, 1 ♂; Río Orinoco, mouth of Río Ocamo, 3 ♂; opposite mouth of Río Ocamo, 3 ♀; Mt. Duida, 2 ♂, 1 ♀; Boca de Sina, Río Cunucunuma, 3 ♂; Sacupana, 1 ♂; Suapuré, 2 ♂; Río Mato, 1 ♀; La Unión, Río Caura, 3 ♂, 3 ♀. DUTCH GUIANA, Paramaribo, 1 ♂, 1 ♀. FRENCH GUIANA: Approuague, 1 ♂, 1 ♀. BRAZIL: Serra do Lua, Rio Branco, 1 ♂.[1]

Myrmoborus lugubris berlepschi (Hellmayr)

Hypocnemis lugubris berlepschi HELLMAYR, 1910 (March), Rev. Franç. d'Orn., I, No. 11, p. 165 Nauta, Perú; ♀; Frankfort Mus. (Berlepsch coll.).

This subspecies apparently occurs on both sides of the Amazon. Two skins from Puerto Indiana, Perú, and five from the mouth of the Río Curaray, Ecuador, are not separable from three skins from Sarayacu, Río Ucayali. Six skins in the Carnegie Museum, Pittsburgh, from São Paulo de Olivença, Brazil, south bank of the Amazon, agree better with the Peruvian and Ecuadorian birds than with a series of *M. l. femininus* from the Rio Madeira, and should be referred to *berlepschi.*

The differences between *femininus* and *berlepschi* are not quite constant. The males do not appear to differ except in size. The females differ also in size and in the color of the auriculars, but one of the Ecua-

[1]Specimens in Field Museum of Natural History, Chicago.

dorian females of *berlepschi* has more brown on the posterior auriculars than most *femininus*, while a female of the latter form from the Rio Madeira, near Borba, has the auriculars largely dull blackish. *M. l. femininus*, it may be said, occupies both banks of the lower Rio Madeira, though I have no records from the Purús.

In Perú, *berlepschi* inhabits only the lower Tropical Zone, being replaced in the upper Tropical Zone by *M. leucophrys leucophrys* which does not descend low enough to conflict with *berlepschi*. On the lower Amazon, however, members of both groups occur at the same places—*griseigula* and *femininus* on the left bank of the lower Madeira, for example. This is important in view of the undoubtedly close relationship between *lugubris* and *leucophrys*. One male of *M. lugubris femininus* from above Borba has the silvery gray of the forehead carried backward over the eye to beyond the posterior margin of the orbit, though in reduced intensity posteriorly, and, though it does not reach the degree of development shown by the whitish superciliary of *leucophrys*, it strongly suggests that species in this particular. The male of *M. lugubris stictopterus* has the typical pattern of the *lugubris* group, but the description of the female indicates that sex to be very like some of the *leucophrys* group. The exact relationship of the two groups has yet to be worked out in detail.

Records of *berlepschi* from Perú to date have been only from Nauta and Iquitos.

There is a possibility that the subspecific name *lugubris* will have to be restricted to birds from east of the Tocantins, while Ridgway's name *hypoleuca* is applied to those from the Tapajoz, Xingú, and Jamundá. The single male at hand from Baião, Tocantins, is darker and duller gray above and on the flanks than the males from a little farther west, and has the silvery gray or white area of the forehead decidedly more restricted, duller, and less spread over the fore part of the crown or above the eyes. It more closely resembles males of *femininus* than those of so-called *lugubris* from the other regions at hand.

Hellmayr (Rev. Franç, d'Orn., I, No. 11, p. 163, 1910) says that a male from Diamantina, near Santarem, has the white of the forehead purer than it is in the type of *lugubris* or in a male from Paricatuba, Rio Tapajoz. This may indicate the constancy of such a character in the easternmost examples, but I would like to see more material before proposing the recognition of two forms in this region. Incidentally, the type locality of *lugubris*, "said to be Pará" but since questioned, may have been properly the east bank of the Tocantins which is not far

removed from Pará, though this apparently is the first definite record from that region.

SPECIMENS EXAMINED

M. l. lugubris. - BRAZIL: Baião, Rio Tocantins, 1 ♂; Tapará, Rio Xingú, 2 ♀; Villa Bella Imperatríz, 9 ♂, 5 ♀; Faro, Rio Jamundá, 2 ♂, 1 ♀.

M. l. femininus.—BRAZIL: Borba, Rio Madeira, 2 ♂, 1 ♀; Igarapé Auará, 8 ♂, 4 ♀; Rosarinho, 2 ♂, 1 ♀; Santo Antonio de Guajará, 1 ♀.

M. l. stictopterus. -BRAZIL: Manacapurú, 1 ♂.[1]

M. l. berlepschi.—PERÚ: Puerto Indiana, 1 ♂, 1 ♀; Sarayacu, Río Ucayali, 3 ♂. ECUADOR: mouth of Río Curaray, 2 ♂, 3 ♀. BRAZIL: São Paulo de Olivença, 2 ♂,[1] 4 ♀.[1]

Myrmoborus myotherinus myotherinus (Spix)

Thamnophilus myotherinus SPIX, 1825, 'Av. Bras.,' II, p. 30 (part; descr. ♂ only), Pl. XLII, fig. 1- no locality, Fonteboa, Brazil, suggested by Berlepsch and Hartert, 1902; type lost.

There seems to be too much individual variation in the birds of this species found south of the Amazon in Perú, Bolivia, and Brazil as far east as Teffé, to make their subdivision advisable. Females from nearest the Amazon are rather browner above than those from the Ucayali, and the specimens from the middle Marañón are, perhaps, a trifle more deeply colored than the skins from western Brazil, but there is no assured difference. Females from southeastern Perú also are brown above but some of them match the Ucayali skins. All of these are relatively pale on the under side and with pure white throats. The row of spots across the upper breast is often obsolete and furnishes no criterion of value. A number of females from Todos Santos, the Río Chimoré, and the Río Espíritu Santo in Bolivia are like the southeast-Peruvian females above but have the lower under parts somewhat brighter ochraceous and, in addition, have the throat decidedly buffy, at least on the lower portion, sometimes up to the chin. In these respects they show a decided approach toward the characters of *M. m. sororius* of the Matto Grosso region of Brazil.

The males are all very much alike. Possibly the Bolivian specimens are slightly paler on the back and flanks, but the difference is inconsiderable. If there are any forms to be recognized in this material, the west-Peruvian specimens might be called *melanosticta* and the Bolivian examples, *melanolaema*, as described long ago from these respective regions, but I do not believe that either is entitled to recognition.

According to the material at hand, *myotherinus* is found on both banks of the upper Ucayali in the neighborhood of the mouth of the

[1]Specimens in Carnegie Museum, Pittsburgh

Urubamba, but, on the lower portion of the river, it is found only to the westward and is absent from the east bank and from the area between that stream and the Javari. There its place is taken by *M. melanurus*, in the account of which, given hereunder, a fuller discussion is made of the significance of this fact.

Peruvian records are all from the lower humid Tropical Zone. Aside from the localities in the subjoined list of specimens, the records are from Xeberos, Chamicuros, Chyavetas [=Chayavitas], Santa Cruz (Río Huallaga), Maynas, Chuchurras, Monterico, San Gaban, and Yahuarmayo.

Myrmoborus myotherinus napensis, new subspecies

TYPE from the mouth of the Río Curaray, eastern Ecuador. No. 255,922, American Museum of Natural History. Adult female collected December 6, 1925, by Carlos Olalla and sons.

DIAGNOSIS.—Similar to *M. m. elegans* of southeastern Colombia and the region of Mt. Duida, Venezuela, but darker. Males not always clearly separable but with the abdomen averaging darker gray (less whitish) though paler than in the males of *M. m. proximus*. Females distinctly darker on the upper surface than those of *elegans*, less rufescent, more olivaceous brown; superciliary line and forehead duller; under parts averaging decidedly paler ochraceous, with the flanks browner and less rufous; tips of upper wing-coverts somewhat paler orange ochraceous and outer margin of alula white or nearly so, not so strongly ochraceous.

RANGE.—Eastern Ecuador and northeastern Perú (north of the Amazon) along the Napo and its tributaries; probably west to the Bobonaza and the lower Río Tigre; east to Pebas.

DESCRIPTION OF TYPE.—Back dark Olive x Olivaceous Black, tips of feathers a little brighter; rump more brownish; central interscapulars with a white medial area on their inner webs, making a small but distinct patch concealed in the center of the back; forehead a little paler, tinged with Buffy Brown; lores, a narrow line over the eye, the subocular region, the auriculars, and the sides of the neck black, forming a black mask on the sides of the head; upper part of the lores with whitish shaft-lines; the black mask bordered above the auriculars by an inconspicuous grayish stripe separating it from the brown occiput and nape. Chin, throat, and malar region broadly white, the feathers of the malar region with black tips, faintly suggested on part of the middle throat; feathers on the lowermost part of the throat with broad ochraceous tips and small, dusky, subterminal shaft-spots, most prominent laterally but even there not very conspicuous; breast and belly buffy ochraceous, with white subterminal areas which come very close to the tips of some of the feathers in the middle of the abdomen; sides of breast much darker, inclining toward the color of the back, though with lighter tips; sides of the belly deeper than the middle, shading into the Brussels Brown of the flanks; under tail-coverts Ochraceous-Buff. Wings and tail Fuscous-Black, with outer margins of quills dark Olive-Brown, except that the margin of the outermost primary is buffy white; greater and middle upper wing-coverts blackish, with broad tips light Cinnamon-Buff; innermost lesser series more olivaceous, without pale tips; tips of primary-coverts not pale; outer margin

of alula nearly pure white; under wing-coverts dull buffy; inner margins of remiges inconspicuously pale, grayish. Maxilla black (in dried skin); mandible whitish at base, brown at tip; feet grayish brown. Wing, 63 mm.; tail, 39; exposed culmen, 14; culmen from base, 17; tarsus, 26.

REMARKS.—Males Slate-Gray above, with a concealed patch of white on the mantle as in the females; forehead Light Gull Gray, the hue continued laterally over the eye to the nape in a pale stripe; black mask on sides of the face as in the female, reaching narrowly over the eye between the pale superciliary stripe and the orbit; chin and throat solidly black, continuous with the black mask; rest of under parts Deep Gull Gray. Wings and tail sooty black; outer margins of quills the color of the back except that the margin of the outermost primary is white; most of upper wing-coverts black with white tips; innermost lesser coverts gray without white tips; under wing-coverts pale gray. Bill entirely black; feet grayish black. Wing, 63.5–68.5 mm.; tail, 35–40; exposed culmen, 14 16; culmen from base, 18–19; tarsus, 25–27.

An immature male, taken July 16, is much like the adult males in general color but has the throat white, the posterior under parts quite pale gray, the black mask duller than in the adult, the silvery gray superciliary line and forehead less sharply defined, the remiges and rectrices brownish (but the tips of the upper wing-coverts white as in the adult). Other males, not fully adult, have the throat black but the belly paler than in the adult and somewhat tinged with brownish.

The females are somewhat variable. Some of them are more deeply colored than the type while others are paler; some have the row of dusky shaft-spots bordering the lower throat larger than in the type; the pale superciliary line is sometimes tinged with ochraceous though not so brightly as in *elegans;* the white shaft-streaks of the upper lores are often absent; the general tone of the upper parts may be lighter or darker but does not reach the rufescence of *elegans.* Wing, 62.5-67 mm.; tail, 35-39; exposed culmen, 13-15.5; culmen from base, 17–19; tarsus, 25-27.75.

Peruvian records are from Pebas, Río Tigre, and Nauta.

During the comparative studies made in the investigation of this species, several interesting facts have been discovered concerning the limits of distribution of the various forms. Although the additional localities are given in the list of specimens examined, it may be well to call attention to them here also.

M. m. elegans (SCLATER) reaches Brazil on the upper Rio Negro (left bank at San Gabriel) and Rio Uaupés (Tahuapunto). It also inhabits the upper Orinoco and the lowlands around Mt. Duida.

M. m. proximus Todd, as might be expected, continues eastward from Caviana (the type locality) to the west bank of the Madeira (Rosarinho and Santo Antonio de Guajará).

M. m. ardesiacus Todd extends upward along the right bank of the Rio Negro at least as far west as Tabocal (to nearly 65 degrees w. long.).

Specimens Examined

M. m. elegans.—Colombia: La Morelia, 2 ♂, 2 ♀; Florencia, 1 ♂, 2 ♀; "Bogotá," 1 ♀. Venezuela: Mt. Duida and upper Orinoco, 17 ♂, 4 ♀. Brazil: Rio Uaupés, Tahuapunto, 1 ♂; Rio Negro, San Gabriel, 2 ♂.

M. m. napensis.—Ecuador: mouth of Río Curaray, 1 ♂, 4 ♀ (incl. type); Río Suno above Avila, 3 ♂, 1 ♀; lower Río Suno, 1 ♂, 2 ♀; below San José de Sumaco, 3 ♂, 1 ♀; mouth of Lagarto Cocha, 1 ♂. Perú: Puerto Indiana, 4 ♂, 1 ♀; Apayacu (=Anayacu). 1 ♀.

M. m. myotherinus.—Brazil: Teffé 4 ♂; São Paulo de Olivença, 7 ♂[1], 2 ♀[1]. Perú: Sarayacu, 1 ♂; Santa Rosa, upper Ucayali, 5 ♂, 1 ♀; Lagarto, upper Ucayali, 10 ♂, 5 ♀; Puerto Bermúdez, 4 ♂[2], 1 ♀[2]; Yurimaguas, 1 ♂[2], 1 ♀[2]; Pomará, Río Marañón, 6 ♂, 2 ♀; La Pampa, 1 ♂, 3 ♀; Río Tavara, 1 ♂, 1 ♀. Bolivia: Todos Santos, Cochabamba, 9 ♂, 6 ♀; mouth of Río San Antonio, Río Espíritu Santo, 1 ♂, 2 ♀; Mission San Antonio, Río Chimoré, 2 ♂, 2 ♀; Province del Sara, 3 ♂[1], 1 ♀[1]; Río Surutú, 3 ♂[1], 4 ♀[1]; Río Yapacani, 1 ♂[1].

M. m. sororius.—Brazil: Morinha Lyra, Matto Grosso, 1 ♂; Rio Roosevelt, "Camp 14," 1 ♂; Calama, Rio Madeira, 1 ♂.

M. m. ochrolaema.—Brazil: Rio Tocantins, Baião, 3 ♂, 3 ♀; Mocajuba, 1 ♂, 2 ♀; Cametá, 1 ♂; Rio Xingú, Tapará, 3 ♂, 1 ♀; Porto do Moz, 5 ♂; Villarinho do Monte, 1 ♂; Rio Jamauchim, Tucunaré, 1 ♂, 1 ♀; Rio Tapajoz, Igarapé Brabo, 4 ♂, 6 ♀; Tauarý, 3 ♂; Caxiricatuba, 2 ♂, 1 ♀; Aramanáy, 2 ♂, 2 ♀; Igarapé Amorín, 1 ♀; Boim, 1 ♀; Rio Amazonas, Villa Bella Imperatriz, 6 ♂, 5 ♀; Rio Madeira, Borba, 5 ♂, 1 ♀; Igarapé Auará, 3 ♂, 3 ♀.

M. m. proximus.—Brazil: Rio Madeira (left bank), Rosarinho, 11 ♂, 6 ♀; Santo Antonio de Guajará, 1 ♂, 1 ♀.

M. m. ardesiacus.—Brazil: Rio Negro, Igarapé Cacao Pereira, 7 ♂, 4 ♀; Santa Maria, 1 ♂; Tabocal, 1 ♀.

M. m. incanus.—Brazil: Tonantins, 2 ♂[1], 2 ♀[1].

Myrmoborus melanurus (Sclater and Salvin)

Hypocnemis melanura Sclater and Salvin, 1866, P. Z. S. London, p. 186 - Cashaboya (=Cashiboya) (♂) and upper Ucayali (♀); British Mus.

Two males and two females from "Sarayacu," not far from the type locality, and a female from Orosa represent this rare species in the collection before me. One of the males has a distinct white area concealed on many of the lower interscapulars, a feature not shown by the

[1]Specimens in Carnegie Museum, Pittsburgh.
[2]Specimens in Field Museum of Natural History.

other specimens at hand and apparently absent in the few previously known skins. Otherwise the series agrees with the original description.

The general similarity of this species to some of the forms of *M. myotherinus* in a great many details gives rise to a strong suspicion that *melanurus* belongs in the *myotherinus* group. This suspicion is deepened by the fact that there is nearly, if not quite, perfect geographic replacement. *M. m. myotherinus* ranges westward in Brazil from Teffé to São Paulo de Olivença, possibly to the east bank of the Javari, and, in Perú, from the west bank of the lower Ucayali westward to the middle Marañón near the mouth of the Utcubamba; only on the upper Ucayali are there positive records from the east bank of that river. On the east bank of the lower Ucayali and along the south bank of the Amazon between the Ucayali and the Javari, only *melanurus* has been found The single conflicting circumstance is the locality "Sarayacu" on four of the specimens of *melanurus* now at hand together with a male of *myotherinus* which has the same locality and the same date as one of the *melanurus* skins. Since the collectors of these skins (Carlos Olalla and sons) worked on both sides of the Ucayali at Sarayacu and did not distinguish the specimens obtained on each bank, there is no proof that the two forms were not secured on opposite sides of the river, as I suspect to be the case. Nevertheless, until my belief is strengthened by additional records from the region, I must leave the matter in abeyance and recognize *melanurus* as a distinct species.

SPECIMENS EXAMINED

M. melanurus.—PERÚ: "Sarayacu," 2 ♂, 2 ♀; Orosa, Río Amazonas, 1 ♀.

Myrmeciza lophotes (Hellmayr and Seilern)

Percnostola lophotes HELLMAYR AND SEILERN, 1914 (May), Verh. Orn. Ges. Bayern, XII, Heft 1, p. 90 Río San Gaban, Carabaya, s. e. Perú; ♂; Munich Mus.

A female from Lagarto, upper Ucayali, presents the first evidence of the occurrence of this species outside of the Carabaya district of Perú whence it was described.

This specimen does not agree perfectly with the published accounts of the female, but its apparent differences are not pronounced and may be less than supposed, due to the manner of description (that of pointing out certain differences between the sexes) rather than to actual differentiating characters. Thus the pale tips on the upper wing-coverts are not strongly different in color from the subterminal parts of the feathers, though the difference that exists is rather sharply accomplished. The primary-coverts are not blackish but rufescent, except for slightly more

dusky inner webs, and the under wing-coverts are not gray but cinnamomeous. The most striking variance is on the throat and breast which are conspicuously marked by dusky shaft-lines, slightly wider toward the tips of the feathers. Measurements and other characters are in agreement.

Aside from the relatively great length of the crest, this species does not show any trenchant differences from the other species of *Myrmeciza* as recognized by Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, (3), 1924), and need not be separated generically from the rest. The genus is extremely versatile in its characters, and I can not divide it at all satisfactorily. The genera *Myrmoderus*, *Myrmelastes*, *Myrmophylax*, and *Myrmedestes* are equally unsatisfactory and intergrade insensibly with *Myrmeciza*. Unless a genus is to be recognized for each specific group I see no course but to call all of them *Myrmeciza*. Except for the specific characters, there is no feature of any of them that does not find itself either fully developed in some other species or forming part of a chain of characters that presents every gradation from one extreme to the other. That there are differences is recognized, since there are numerous excellent species, but I do not consider the differences to be of generic value. There are also, it is true, many widely differing extremes, but I believe that they are only the unseparated peripheral developments of a single very plastic genus. To recognize a host of monotypic genera results in time in the concealment of the existing relationships. The differences are already signalized by the specific names, and I see no value in recognizing numerous genera on the characters which already must serve to differentiate the species.

Myrmeciza hyperythra (Sclater)

Thamnophilus hyperythrus Sclater, 1855 (April), Edinb. N. Philos, Journ. (N. Ser.), I, p. 235—Chamicuros, Perú; ♀; British Mus.

A series of forty-three specimens from nearly all parts of the range of this species shows a small amount of individual variation but nothing that can be correlated with distribution. The males are particularly uniform showing a little difference in the amount of white concentrated on the bend of the wing. The females vary in the same particular and also in the depth of ventral coloration (partly attributable to differences in age) and in the grayness or rufescence of the under tail-coverts. Some females also show a tinge of rufescence on the white spots of the lesser wing-coverts which are usually pure white.

Four skins from the mouth of the Curaray and Lagarto Cocha, on the Napo, extend the known range of the species into eastern Ecuador.

I am unable to recognize the genus *Myrmelastes* from this species which is the genotype. In structural features the bird is a large *Myrmeciza* which has no characters other than its size. The bare postocular patch is shown by *Myrmeciza exsul* and other species whose separation from *Myrmeciza* is not in question.

Records in Perú are from Chamicuros, Pebas, Samiría, Nauta, Iquitos, Santa Cruz (Rio Huallaga), Xeberos, and lower Ucayali.

SPECIMENS EXAMINED

M. hyperythra.—PERÚ: Sarayacu, 7 ♂, 5 ♀; Orosa, 1 ♀; Lagarto, upper Ucayali, 4 ♂, 5 ♀; Santa Rosa, Río Ucayali, 5 ♂, 3 ♀; mouth of Río Urubamba, 2 ♂; "Apayacu" (=Anayacu), 2 ♂, 1 ♀. BOLIVIA: lower Río Beni, 1 (♂). ECUADOR: mouth of Río Curaray, 3 ♂; mouth of Lagarto Cocha, 1 ♀. BRAZIL: Teffé, 2 ♂, 1 ♀.

Myrmeciza melanoceps (Spix)

Thamnophilus melanoceps Spix, 1825, 'Av. Bras.,' II, p. 28, Pl. xxxix, fig. 1—in sylvis Parae (errore; subst. Rio Iça, n. w. Brazil; Hellmayr, 1924); ♀; Munich Mus.

A series of twenty-six skins from Colombia, Ecuador, and Perú are relatively uniform and are all to be referred to *melanoceps*, though none of them is strictly topotypical. Five of the males from Perú and Ecuador show varying amounts of white concealed on the interscapulars, ranging from a very slight trace on a Puerto Indiana skin to a large and conspicuous patch on a bird from the lower Río Suno. There are slight traces of white on the under wing-coverts of four of these skins but none on the inner margins of the remiges and none on any of the females. I suspect this to be a variational tendency in the direction of *M. goeldii* of the Rio Purús, Brazil, though I have none of this species for comparison.

There is no suggestion of unusual length of tail in the birds from Ecuador, as noted by Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 267, footnote *a*, 1924) for two males from Archidona and Napo Village, and also for Spix's type. Hellmayr's measurements show the males to have tails measuring 78 and 80 mm., respectively, and the female (type) to have the tail 72 mm. In the series at hand, the measurements of the tail are as follows: Colombia, (♂) 57–60.5 mm., (♀) 54–57; Ecuador, (♂) 59–61, (♀) 55.5–60.5; Perú, north of the Amazon, (♂) 59.5–64, (♀) 56–58. Other measurements are in similar agreement. There appears to be no evidence, therefore, on which to recognize two forms on opposite sides of the Amazon.

Other records from Perú are from Pebas, Yaguas (near Pebas), Río Tigre, Santa Cruz (Huallaga), Yane Yacu (near Yurimaguas), Maynas, Cashiboya, Río Ucayali, Loretoyacu, and Río Javarri.

SPECIMENS EXAMINED

M. melanoceps.—COLOMBIA: Florencia, Caquetá, 3 ♂, 3 ♀. ECUADOR: mouth of Río Curaray, 3 ♂, 3 ♀; lower Río Suno, 1 ♂. PERÚ: Puerto Indiana, 4 ♂, 2 ♀; Apayacu (=Anayacu), 1 ♀; Sarayacu, 1 ♂, 2 ♀; Lagarto, upper Ucayali, 1 ♂, 2 ♀.

Myrmeciza fortis fortis (Sclater and Salvin)

Percnostola fortis SCLATER AND SALVIN, 1867, P. Z. S. London, p. 980, Pl. XLV (*Percnostola funebris* on plate)—Pebas (♂♂) and Chyavetas [=Chayavitas] (♀), Perú; British Mus.

The arrangement of this species is very puzzling. Todd (Proc. Biol. Soc. Wash., XL, p. 169, 1927) found no differences between skins from eastern Ecuador and a long series from the Rio Purús, São Paulo de Olivença, and Caviana, Brazil. Two birds in female plumage (one sexed as male) from Teffé, now at hand, are paler on the under surface than Ecuadorian females, and northeastern Peruvian skins are intermediate, varying in both directions. Since there appears to be some variation in depth of color due to age, it is possible that part of the apparent differences here exhibited are from that cause. An extensive series from different parts of the range will be needed to determine the point. Further nomenclatorial difficulties are presented by the fact that the cotypes are from both sides of the Amazon and may have to be segregated if an additional form is separated from *fortis* in the neighborhood of the Amazon.

Birds from north of the Amazon are inclined to show a stronger tinge of grayish on the anterior part of the mantle than do those from south of the river, thus approaching *M. f. incanescens* described from Tonantins, also on the north bank, but the difference in the present series is not constant. Five skins from Astillero, southeastern Perú, present a decided extension of the known range of the species. As usual in this group, the adult males show no pronounced difference from those of *fortis*. Adult females are needed from this region for study. One specimen apparently is in female plumage with certain modifications of the coloration exhibited by females from other regions, but I judge this bird to be correctly sexed as a male and to represent an interesting stage in the development of the male plumage. Several young birds are at hand from farther north, from which the following conclusions may be drawn.

Juvenal head and body plumage probably is rather uniform fuscous black in both sexes. A female from the mouth of the Curaray, Ecuador, taken November 21, and two males from Santa Rosa, Río Ucayali, Perú, taken December 21 and 25, all show remains of this plumage on breast, sides, mantle, and head. The males are acquiring a dark rufous-brown plumage on the back, with traces of white concealed on the mantle; dark gray on breast (a little paler on the throat), with a variable amount of blackish subterminally on these feathers; the loose blackish feathers of the top of the head are being replaced by stiffer feathers which are margined and tipped with dark chestnut.

The young Astillero male, taken January 29, has the whole top of the head dark chestnut, with blackish shaft-marks, though the chestnut is sometimes reduced to narrow borders and tips. The breast has a minimum of subterminal blackish and there is no white on the mantle, but the general color is otherwise a good match for that of the young Santa Rosa males so far as they have acquired the first annual plumage. The wings and tail are dark rufous, the belly is dark gray, and the flanks are a little lighter rufous brown than the back—all much like the adult female except that the tones are distinctly darker. There is no indication of molt on this skin which appears to represent the full first annual plumage of the male, unmodified in any way.

Making allowances for probable differences in season, which are corroborated by other specimens, a slightly later stage is shown by a young male from Teffé, taken July 31. This specimen shows the forehead and crown already set with pure black but the occiput and nape are still tipped with chestnut. The anterior mantle, scapulars, and upper tail-coverts have a few dark gray feathers coming in; the under parts are molting to blackish gray; the inner four or five primaries and the upper tertials are molting into gray; the greater upper wing-coverts and a few of the median series are gray. A still later stage is shown by a male from Anayacu, taken January 22. The nape is still tipped with chestnut and a few rufous feathers remain on the scapulars, lower back, and upper tail-coverts; the upper wing-coverts are all gray; a few paler gray feathers remain on the anterior under parts; the flanks and under tail-coverts are only partially gray. The outer primaries and the inner secondaries are still rufous; the two upper tertials are gray; the lower one not yet grown out. The two outer rectrices are rufous; the others gray.

A male from Sarayacu, taken April 1, is a little farther advanced in certain particulars, but less advanced in others. Only the middle rectrices are gray; the primaries are all molted but the secondaries are less

advanced than in the Anayacu skin; the tertials are irregular, and one rufous one remains on the left side. Otherwise the plumage is more advanced than in the Anayacu skin.

A male from Orosa, taken October 7 is in practically complete adult dress with only a trace of rufous on the uropygium.

Females are fewer and most of them are adult. The youngest is the female from the mouth of the Curaray, taken November 21. Here the plumage is much like that of the adult female though a little softer, except for some fuscous black juvenal plumes on the top of the head, back, breast, sides, and throat. Even the alula has a whitish outer margin though it is not so sharply defined as in adult females. The throat is as dark as the breast.

A female from La Morelia, Colombia, taken July 21, has fewer juvenal feathers, but the throat is much whiter than the breast, as is the middle of the abdomen.

A Río Suno bird, taken March 14, is in full first-annual plumage, possibly just beginning molt, and resembles the adult females except for whiter throat and belly, darker breast, and softer plumage. A very few new feathers in the sheath on occiput and mantle are colored exactly like the areas in which they are appearing.

A bird from Teffé, Brazil, collected August 3, is sexed as a male but is exactly like an adult female from the same place except for softer plumage and is unlike the young male from Teffé. Probably it is wrongly sexed.

Of four adult males from Astillero, Perú, taken in late January and early February, three are marked as having enlarged testes, and show indications of beginning molt. Presumably this marks the close of the breeding season. The Astillero bird in first annual plumage is dated January 29. A Teffé male, collected August 3, is marked as with enlarged testes and the bird in full first annual plumage was taken the same day. These facts make it probable that the first annual plumage is worn until after the following breeding season; whether or not the birds breed in that plumage remains to be discovered. A similar conclusion was reached in the case of *Pyriglena* (Amer. Mus. Novit., No. 509, p. 8, 1931).

Also similar to the case of *Pyriglena,* is the occurrence of a remicle in some examples of both sexes of this species.

Other records of *fortis* from Perú are from Pebas and Chyavitas (cotypes), Yurimaguas, Yaguas (near Pebas), and Loretoyacu.

SPECIMENS EXAMINED

M. f. fortis. PERÚ: Apayacu (=Anayacu), 4 ♂; Orosa, 1 ♀; Sarayacu, 1 ♂ 2 ♀; Santa Rosa (Río Ucayali), 3 ♂, 1 ♀; mouth of Río Urubamba, 2 ♂; Astillero, 5 ♂. ECUADOR: Río Suno, above Avila, 3 ♂, 1 "♂" (= ♀ ?); lower Río Suno, 1 ♂, 2 ♀; mouth of Río Curaray, 2 ♀. COLOMBIA: La Morelia, 1 ♀. BRAZIL: Santa Isidoro, Teffé, 2 ♂, 1 ♀, 1 "♂" (= ♀ ?). "UPPER AMAZONS": 1 (♂).

Myrmeciza atrothorax maynana Taczanowski

Myrmeciza maynana TACZANOWSKI, 1882, P. Z. S. London, p. 32—Yurimaguas, Perú; ♂; formerly Warsaw Mus., now lost.

A careful study of Taczanowski's original description, in the light of such material as is available to me, has led me to the conclusion that the name *maynana* is applicable solely to the birds found south of the Marañón and west of the Huallaga in Perú, of which the type specimen is the only example recorded. This conclusion has, perforce, been reached without an examination of the type, but Taczanowski has been proved to be so careful a taxonomist that great reliance may be placed in his descriptions.

Material from other parts of Perú does not fit the original description of *maynana*. Males from extreme northeastern Perú, north of the Amazon near the mouth of the Napo, are so nearly uniform black on the under side that it is impossible to distinguish the flanks and the belly under separate color terms as is done for *maynana*. On the other hand, males from east of the Huallaga and from the Ucayali have the upper parts only a little less warmly brown than in *M. a. melanurus*, and can not be described as sooty grayish, faintly washed with brownish, as is said to be the case in *maynana*. In these points, *maynana* appears to be exactly intermediate between the two divergent series at hand from opposite banks of the Amazon in eastern Perú. The upper parts must be very dark as in the birds from the mouth of the Napo; the under parts must be distinctly grayish laterally as in the birds from east of the Huallaga though there may be a slightly greater posterior extension of black on the lower belly than in that form.

Since neither extreme can be properly identified with *maynana*, it seems best to give each of them a different name, leaving *maynana* to the region west of the Huallaga, a range that is frequently inhabited by similarly distinctive forms of other species. The female remains unknown.

Myrmeciza atrothorax tenebrosa, new subspecies

TYPE from Puerto Indiana, Río Amazonas (north bank), Perú, No. 231,795, American Museum of Natural History. Adult male collected July 13, 1926, by Carlos Olalla and sons.

DIAGNOSIS.—Somewhat similar to *M. a. melanurus* from south of the Amazon in Brazil, but very much darker. Males with only a faint tinge of deep brown on the anterior upper surface; lower parts almost uniform black, with the belly and flanks faintly duller than the breast but not gray or brown; white spots on upper wing-coverts minute; sides of head with only a faint grayish tinge. Female unknown.

RANGE.—Northeastern Perú north of the Amazon.

DESCRIPTION OF TYPE.—General coloration dull black, deepest on chin, throat, breast, lower back, and under tail-coverts; forehead with a very faint grayish tinge apparent also on the malar region; auriculars somewhat sootier; from crown to middle of back tinged with very dark Mummy Brown; mantle with an extensive patch of white concealed at the bases of the feathers; belly and flanks somewhat duller than the breast, with a very faint dark brown tone visible in certain lights; wings and tail blackish, their external margins deeper black; upper wing-coverts black with minute white tips on most of the feathers; under wing-coverts blackish. Bill black (in dried skin); feet pale brown. Wing, 63 mm.; tail, 52; exposed culmen, 15; culmen from base, 18; tarsus, 26.

REMARKS.—Ménégaux and Hellmayr (Bull. Soc. Philom. Paris, (Ser. 9) VIII, p. 36, 1906) discussed a bird collected by Castelnau and Deville in northeastern Perú, now in the Paris Museum ("No. 1847. 1140; no locality on the label but all the specimens preceding it in the catalogue of entry are from Pebas whence it probably also came"; Hellmayr MS.). Dr. Hellmayr has been kind enough to compare this specimen with one of my Puerto Indiana skins and pronounces it to be essentially the same in contrast to specimens from south of the Amazon. A specimen in the British Museum from Samiría is more like the south bank form described below, under which it is discussed in greater detail. It is apparent that *tenebrosa* inhabits the region from the mouth of the Napo eastward at least as far as Pebas, but its range appears to be cut off from that of typical *atrothorax* for which I have no records from west of the Rio Negro in Brazil. Similarly the range is cut off from that of *maynana*. It would be possible for *tenebrosa* to range westward from the Napo to the Chinchipe or for *maynana* to extend westward from the Huallaga and cross the middle Marañón to the Chinchipe, but there are no records nor specimens of either from these avenues of possible connection, though considerable collecting has been done there at various times. The lines of communication have yet to be discovered.

Myrmeciza atrothorax obscurata, new subspecies

TYPE from Lagarto, upper Ucayali, Perú. No. 239,172, American Museum of Natural History. Adult male collected March 25, 1925, by Carlos Olalla and sons.

DIAGNOSIS.—Males similar to those of *M. a. melanurus* from western Brazil, south of the Amazon, but with upper side slightly darker brown; black of breast continued much farther posteriorly over the upper abdomen; white or whitish spots

on upper wing-coverts larger. Females nearest to those of *M. a. atrothorax* but decidedly darker brown on the upper surface, more deeply rufescent on the breast, and darker, more sooty olive brown on the flanks and crissum; spots on upper wing-coverts much smaller, often minute.

Range.- Eastern Perú south of the Amazon and east of the Huallaga, including the Ucayali Valley southward to near the mouth of the Río Urubamba.

Description of Type. Top of head and mantle dark Dresden Brown; a broad white patch concealed at the bases of the interscapulars and separated from the brown tips by a black subterminal band; forehead inclined to grayish but tipped with the color of the back; rump dull Mummy Brown; upper tail-coverts blackish. Lores, a broad superciliary stripe reaching to the nape, auriculars, and malar region Neutral Gray; chin, throat, breast, and upper abdomen black; sides black with gray tips; flanks Deep Neutral Gray, with a more or less noticeable wash of Dresden Brown; under tail-coverts blackish; wings fuscous, with outer margins dark brownish; upper wing-coverts fuscous, with black subterminal bands and relatively large, angular, white spots at tips (about 1 mm. in diameter); outer margins of these coverts Dresden Brown; under wing-coverts blackish, with a white patch at base of primaries and white tips along the outer margin of the wing; tail black. Bill blackish (in dried skin); mandible slightly browner; feet dull brown. Wing, 60 mm.; tail, 55; exposed culmen, 16.5; culmen from base, 19.25; tarsus, 25.5.

Remarks.--Top of head and mantle dark Prout's Brown x Raw Umber, with a white patch concealed at bases of interscapulars and with subterminal black as in the males; forehead inclined to grayish subterminally; rump and upper tail-coverts Sooty Black, the rump somewhat obscurely tipped with the color of the back; lores, superciliary region, auriculars, and malar region dark brownish gray. Chin whitish, posteriorly tinged with ochraceous; throat deeper, orange ochraceous; breast still deeper, Xanthine Orange x Amber Brown, becoming slightly paler on middle of belly and browner on sides; flanks sooty black, with a slight wash of dark brown; under tail-coverts more uniform, blackish. Wings fuscous black, with outer margins faintly warmer; upper wing-coverts blackish, with faintly browner outer margins and minute white spots at tips; under wing-coverts dull grayish (tinged with ochraceous and with pale subterminal spots near outer margins of wing); inner margins of remiges faintly cinnamomeous buff; tail uniform black. Maxilla black (in dried skins); mandible paler; feet pale fleshy brown. Wing, 56-59 mm.; tail, 46-48; exposed culmen, 14.25–15; culmen from base, 17.75–18; tarsus, 24.75–26.

There is a specimen in the British Museum from Chamicuros (right bank of the lower Huallaga) and one from Samiría, Perú. Through the kindness of Dr. C. E. Hellmayr and of Mr. N. B. Kinnear of the British Museum, a comparison has been made between these two skins and a paratype of the present form from Sarayacu, lower Ucayali. Mr. Kinnear

reports that the Chamicuros specimen is even browner above than the Sarayacu bird and has still larger spots on the upper wing-coverts. The Samiría specimen is said to have a browner rump and belly than the Chamicuros skin; feet in all three skins dusky. Another male from Sarayacu in the Paris Museum was compared by Dr. Hellmayr with the American Museum specimen and found to be exactly like it.

The paratype at hand from Lagarto is slightly duller above than the type but even in its extreme of variation it does not answer to the description of *maynana*.

The reference of the specimen from Samiría to this form is not to be explained so long as Samiría is taken to be a locality on the north bank of the Amazon near Pebas, as has been assumed heretofore. So far as I can discover, there is no published basis for this assumption. The Samiría skins in the British Museum were all collected by John Hauxwell and were obtained by the British Museum from the Salvin-Godman collection. The Salvin-Godman collection contained skins of other birds collected by Hauxwell at Chamicuros, Elvira, Pebas, Nauta, and other Peruvian localities besides Samiría, so that in the absence of other contributory evidence, there is some variety of geographic localities in which to search for the place in question. Nowhere on the north bank of the Amazon or Marañón can I find a "Samiría" though there is a Laguna de Samira some distance east of Pebas. However, on the south bank of the lower Marañón, east of Chamicuros and across the Marañón from a point between Elvira and Nauta, the Río Samiría (or Río Chamicuros) passes through the Laguna de Samiría and empties into the Marañón near the Isla Samiría. The juxtaposition of these various places is highly suggestive and coupled with the fact that various other birds known from Samiría are known also (if not otherwise solely) from the south banks of the Marañón and Amazon renders the probability very nearly a certainty that Hauxwell's "Samiría" is this one. If such is the case, the reference of a Samiría skin to *obscurata* instead of *tenebrosa* is perfectly regular.

Among the material examined in the present study is a male from Igarapé Brabo, left bank of the lower Rio Tapajoz, Brazil. This bird possibly ought to belong to *M. a. stictothorax*, described from Apaçy, Rio Tapajoz (I do not know which bank), but it is not to be distinguished from *melanura* though at the maximum of dorsal brightness for that form. There is no trace of whitish streaks on the throat as described for male *stictothorax*. More material is needed from the Tapajoz.

SPECIMENS EXAMINED

M. a. atrothorax.—BRITISH GUIANA: Rockstone, Essequibo R., 1 ♂. FRENCH GUIANA: Cayenne, 1 ♂, 2 ♀; Tamanoir, 1 ♂; Mana, 1 ♂; Approuague, 1 ♂. VENEZUELA: Maripa, 1 ♂, 1 ♀. Boca de Sina, 1 ♂. 1 ♀; (vicinity of Mt. Duida), 30 ♂, 23 ♀. BRAZIL: San Gabriel, Rio Negro, 5 ♂, 5 ♀; Santa Maria, 2 ♂; Santa Isabel, 1 ♂, 2 ♀; Mirapinima, 1 ♀; Campos Salles, Manaos, 2 ♂, 1 ♀; Hacienda Rio Negro, Manaos, 8 ♂, 6 ♀; Faro, Rio Jamundí, 4 ♂, 1 ♀.

M. a. melanurus.—BRAZIL: Chapada, Matto Grosso, 2 ♂, 2 ♀; Tapirapoan, 2 ♂; Utiarity, 2 ♂, 2 ♀; Siete de Septembre, 1 ♀; "Camp 4," Rio Roosevelt, 1 ♀; "Telegraph Line," Rio Roosevelt, 1 ♂; Campos Novas, Rio Sipituba, 1 ♂; Igarapé Brabo, Río Tapajoz (left bank), 1 ♂. BOLIVIA: Todos Santos, 4 ♂, 4 ♀; Mission San Antonio, Río Chimoré, 1 ♀; Tres Arroyos, Río Espíritu Santo, 1 ♀.

M. a. obscurata.—PERÚ: Lagarto, upper Ucayali, 2 ♂ (incl. type), 3 ♀; Sarayacu, 1 ♂.

M. a. tenebrosa.—PERÚ: Puerto Indiana, 2 ♂ (incl. type).

Myrmeciza griseiceps (Chapman)

Myrmoderus griseiceps CHAPMAN, 1923 (August 25), Amer. Mus. Novit., No. 86, p. 6—Palambla, Dept. Piura, Perú; ♂; Amer. Mus. Nat. Hist.

This species is extremely puzzling in its affinities. I am not certain that it is as closely related to *Myrmeciza atrothorax* as its general appearance suggests, and am not sure that it is properly placed in the genus *Myrmeciza* (including *Myrmoderus*). On the other hand I am more unwilling to place it in the genus *Formicivora* (=*Neorhopias*) as has been suggested by Mr. Todd (Proc. Biol. Soc. Wash., XL, p. 172, footnote 1, 1927), although there are certain points of resemblance there also.

In various particulars, the species suggests the genus *Cercomacra*, from which it differs principally by a more slender bill, though the widely exposed position of the nostrils is quite typical of *Cercomacra*. Probably the bill alone bears as much resemblance to that of *Myrmochanes* as to that of any other genus, though it is a little more slender than the *Myrmochanes* bill.

The pattern of wing and tail is typical of various species of *Cercomacra* as are the graduated rectrices, moderately slender and long, with the end of the tail well beyond the outstretched feet. Except for the more slender bill there is nothing to argue strongly against the inclusion of this species in *Cercomacra*. Nevertheless, without perfect agreement existing between *griseiceps* and some other genus than *Myrmeciza*, I can see no advantage in removing it from the position given it by its describer.

SPECIMENS EXAMINED

M. griseiceps.—PERÚ: Palambla, 6 ♂ (incl. type), 3 ♀. ECUADOR: Alamor, 2 ♂, 2 ♀; Celica, 2 ♂, 1 ♀; La Chonta, 1 ♀.

Myrmeciza hemimelaena spodiogastra Berlepsch and Stolzmann

Myrmeciza spodiogastra Berlepsch and Stolzmann, 1894, Ibis, p. 397—Borgoña, Chanchamayo Valley, Perú; ♂; Warsaw Mus.

I have no topotypical material and have seen no specimens from other localities that answer the description of the type which is said to have the belly gray, not white, and the flanks brownish olive. Dr. Hellmayr writes me, however, that he has examined the type from Borgoña and also a male from the nearby locality, Amable Maria, and found that the two do not agree with each other; the Amable Maria male has as much white on the belly as Bolivian males of typical *hemimelaena*. This character, therefore, may be variable. The females from Borgoña are said to differ from Bolivian females by having the throat and breast paler rufescent and the under tail-coverts pale rufescent, not bright rufous brown.

A series of skins from the upper Ucayali shows the characters ascribed to the females, though not the gray belly of the males. Other differences from *hemimelaena*, not mentioned by Berlepsch and Stolzmann for the Borgoña specimens, appear in the material at hand. The males have the anterior part of the mantle more grayish or olivaceous and less rufescent than in *hemimelaena;* the gray borders of the feathers on the top of the head are somewhat clearer and paler. In addition, the females usually have the top of the head grayer and less brownish than in *hemimelaena;* the anterior part of the mantle is grayer or more olivaceous, less rufous brown; the flanks are usually grayer olive brown, less rufous; the belly is variable, sometimes whitish medially but in most examples ochraceous buff and rather more sharply defined against the deeper ochraceous color of the breast than in female *hemimelaena*. Some examples, it is true, are hardly to be distinguished, but most of them are separable on the characters mentioned.

A single female from Orosa, south bank of the Río Amazonas, below the mouth of the Ucayali, agrees fairly well with the females from the upper Ucayali, though the absence of records from the lower Ucayali is puzzling. Records from Chamicuros may well belong to the same form.

Dr. Hellmayr advises me that males from São Paulo de Olivença, Brazil, have a gray breast without white as in the type of *spodiogastra*. Thus the character which is casual in the Chanchamayo Valley appears to be constant on part of the upper Amazon. The exact significance of this remains to be determined. Possibly the São Paulo de Olivença birds ought to bear a new name, and possibly the Orosa specimen would prove to belong to such a form rather than to *spodiogastra*, but with the

evidence at hand it seems impossible to break the series from eastern and northeastern Perú at any point. Records from Monterico, Perené, and Puerto Yessup must belong with *spodiogastra* if this form is recognized.

Myrmeciza hemimelaena hemimelaena Sclater

Myrmeciza hemimelaena Sclater, 1857, P. Z. S. London, XXV, p. 48—Bolivia; ♂, ♀; British Mus.

Three specimens from southeastern Perú agree with examples from Bolivia rather than with upper Ucayali skins which are referred to *spodiogastra*. There is much variation, however, among the Bolivian birds. Some of the males have the white of the belly distinctly broader than others which have many of the lateral feathers of the upper abdomen with grayish tips and black subterminal areas, giving a spotted appearance to the region. One male has the auriculars gray instead of black and has paler gray than usual on the sides and upper flanks. The females also vary somewhat in the depth of color on the flanks. Peruvian specimens of both sexes are at the dark end of the series.

Myrmeciza hemimelaena castanea, new subspecies

Type from Río Negro, about thirty-five miles west of Moyobamba, Perú; altitude 2600 feet. No. 234,644, American Museum of Natural History. Adult male collected October 5, 1925, by Harry Watkins.

Diagnosis.—Darker than the other subspecies of *M. hemimelaena* known at present. Males with the deep rufous color of the back invading the nape; inner remiges with no more than a trace of pale terminal spots; paler outer margin of alula obsolete; rump and upper tail-coverts almost uniform with the back; under wing-coverts largely blackish. Females with breast as deeply colored as in *hemimelaena* but usually with the middle of the upper abdomen whitish in strong contrast; inner remiges without pale terminal spots; under wing-coverts more grayish than ochraceous; alula with reduced pale spot at tip; mandible entirely black like the maxilla; lores blackish; top of head dark olivaceous or sometimes rufescent.

Range.—Northern Perú south of the Marañón and west of the Huallaga.

Description of Type.—Top of head sooty black, with very deep grayish brown tips, especially posteriorly; hind neck and upper mantle deep Sepia; lower mantle deep Chestnut x Auburn, with a concealed patch of white bordered subterminally by a broad black band; lower back and upper tail-coverts pure Auburn. Chin, throat, breast, lores, malar region, and auriculars black; tips of feathers on sides of breast gray; belly white on upper median portion, passing into Pinkish Buff towards crissum; flanks light Prout's Brown; under tail-coverts a little brighter. Tail deep Auburn x Chestnut, paler on the under side. Remiges exteriorly deep Auburn x Chestnut, without pale tips; lesser upper wing-coverts near radial margin white, near carpal margin blackish with white tips; median series blackish with pale buff tips; greater series deep Auburn with buff tips and with an indistinct blackish subterminal patch on outer webs; alula blackish with a tiny white spot at tip; primary-

coverts blackish, with outer margin indistinctly Auburn; under wing-coverts largely blackish, paler on under primary-coverts; inner margins of remiges pale Vinaceous-Buff. Bill (in dried skin) black; feet pale brownish. Wing, 59 mm.; tail, 40; ex-exposed culmen, 15; culmen from base, 18; tarsus, 24.5.

REMARKS.—Females with upper surface paler than in the males. Top of head basally sooty grayish with margins Brussels Brown (to light Raw Umber); mantle Auburn to Brussels Brown x Argus Brown, with concealed patch as in the males; rump and upper tail-coverts Argus Brown (to Sudan Brown). Lores, upper malar region, and auriculars grayish; chin, throat, and breast Amber Brown x Mars Yellow; sides of breast olivaceous; middle of belly white (pale Ochraceous-Buff in one skin); flanks as dark as in the male or paler (Brussels Brown x Argus Brown); under tail-coverts light Argus Brown to Sanford's Brown x Amber Brown. White patch absent from shoulder; lesser and median upper wing-coverts blackish with buffy terminal spots (sometimes more whitish on lesser series); greater coverts as in the males or with buffy tips absent from outer feathers; remiges without pale tips; under wing-coverts with traces of buffy tips. Bill entirely black; feet yellowish. Wing, 55–57 mm.; tail, 37–40; exposed culmen, 13–15; culmen from base, 16–18; tarsus, 23.5–25.

Taczanowski's description of *hemimelaena* (Orn. Pér., II, p. 59, 1884) apparently is generalized for specimens from the Chanchamayo Valley and also northern Perú so it is impossible to glean therefrom any characteristics which the author may have noted in the northern examples from Huambo and "Xeveros" (=Jeberos). From the geographic position of these two localities, the resident form of this species is *castanea*.

SPECIMENS EXAMINED

M. h. hemimelaena.—BOLIVIA: Todos Santos, 3 ♂, 3 ♀; mouth of Río San Antonio, 2 ♂, 2 ♀; Mission San Antonio, Río Chimoré, 2 ♂, 1 ♀; Mapiri, 1 ? (♀ ?). PERÚ: La Pampa, 1 ♂; Río Tavara, 1 ♂, 1 ♀.

M. h. spodiogastra.—PERÚ: Lagarto, upper Ucayali, 10 ♂, 8 ♀; Santa Rosa, upper Ucayali, 2 ♂; Orosa, 1 ♀.

M. h. castanea.—PERÚ: Río Negro, west of Moyobamba, 2 ♂ (incl. type), 3 ♀; Río Seco, west of Moyobamba, 1 ♀.

AMERICAN MUSEUM NOVITATES

Number 546 — Published by The American Museum of Natural History, New York City — June 22, 1932

59.79 A 15.6

OBSERVATIONS ON THE COURTSHIP BEHAVIOR OF *AMBYSTOMA JEFFERSONIANUM*

By K. F. Kumpf and S. C. Yeaton, Jr.

The evolution of courtship behavior has recently been shown to have phylogenetic significance (Noble, 1931). The essential similarity of the stages of this activity among related species has been found to occur among salamandrids and was demonstrated among plethodontids by Noble and Brady (1930). Although the same condition appears to hold true among the ambystomids as well, notes already published on the courtship of *Ambystoma jeffersonianum* indicate some deviation from the general pattern of this group (Mohr, 1931). It was therefore considered important to secure, if possible, the complete courtship story of this species. Mohr (1931) has described the essential points of the "Liebesspiel" but has given no detailed account of the activities of mating individuals and has not reported any instances of the actual picking up of the spermatophore by the stimulated female. This paper will present the complete sequence of events from the inception of courtship to the acceptance of the spermatophore.

The individuals under observation were collected on the nights of March 31 and April 10 in the vicinity of Montauk, Long Island, near a large shallow pond about one foot in its deepest section. The salamanders were found on land, under sticks, stones, and mosses. No eggs were seen in the field and apparently no individuals had entered the water at that time.

The activities of two adult males and three noticeably gravid females were recorded the greater part of April 1. On April 4, each of the males of this group received two anterior lobes of fresh pituitary from *Rana pipiens* individuals. Courtship occurred again the night of April 5, and during April 6. A second group of the same number of males and females was observed continuously over a period of five hours on April 11. Between the times of study the sexes were separated and kept in the laboratory icebox.

Observations were made in a dark room illuminated by three red lights of 10-watt power each, although an ordinary electric light was

found to have little effect upon the progress of activities. An Alberene tank (60×30×30 cm.) half filled with tap water was used. The temperature varied between 50° and 55° F. In three of the four periods of study the "Liebesspiel" began in less than fifteen minutes after the introduction of the salamanders into the aquarium and at least sixty spermatophores were deposited by the four males during the entire study.

The initial records made at the time of observation graphically present the outstanding features of the story:

At 10:06 A.M.—A male is going through a series of rapid vibratory movements of his body accompanied by vigorous waving of his tail from side to side. This continues for two minutes.

10:07 A.M.—The other male climbs astride a female and embraces her with his forelimbs just behind her head. After two minutes in this position he clasps her around her hind legs with his head over her tail. He leaves her after a minute and stalks ahead but returns immediately to embrace her again, this time behind the forelegs. Together they swim almost around the tank, the male's body undulating all the time. For thirty seconds they settle quietly in a corner and then make a complete trip around the aquarium. Another few seconds of inactivity after which the male leaves the female's back and proceeds ahead of her. His whole body is undulating and his tail is raised and waving. At the same time he appears to be rubbing his cloacal region over the bottom of the tank. This movement ceases while he pursues another

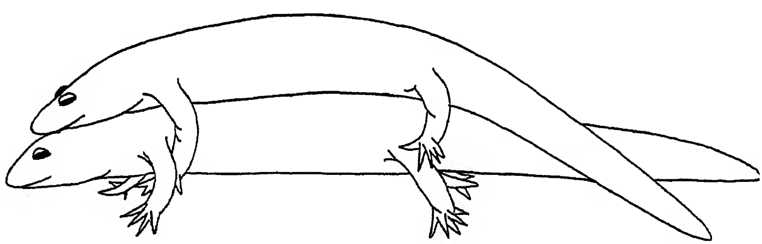


Fig. 1. First position of male in embrace. Male clasping female just behind forelimbs with tip of his snout between anterior corners of her eyes.

female for a few seconds. However, he returns to the first female whom he embraces again at 10:11. They swim around the tank and settle quietly. At 10:13 he departs and moves slightly ahead with wriggling body and rapidly waving tail. First, his head is raised and then his tail until it is at a 90° angle with the bottom of the tank. The female's snout is closely applied to the male's cloaca. In two minutes he deposits two spermatophores about 2.5 cm. apart. The female fails to secure either or even display any interest in them. The male returns to clasp her again for thirty seconds and then leaves to repeat the same wriggling, vibratory movements of his body. As before, the female's snout is near his cloaca as he deposits a third spermatophore and almost immediately a fourth. The female picks up neither. The male starts after another female.

An analysis of all the data acquired confirms the above account and shows that the "Liebesspiel" is begun when a male climbs astride a female and embraces her. If he happens to crawl over her in such a fashion that his head rests over her cloaca he immediately turns directly about and encircles her body with his forelimbs either just before or behind her forelegs. (See Fig. 1.) Both positions have been observed over and over again although the latter is the more common. In a few instances one leg has been seen placed before and one behind her forelegs. The male's forefeet are usually pressed with the inner surface flat against the female's body with digits of the opposite forefeet just touching or alternating. When the female attempts to dislodge the male the digits of the forelimbs are interlocked so that they stand away from her body or the forefeet are placed one over the other. The amount of strength needed to maintain the embrace apparently determines the type of hold used by the male (Fig. 2). It has been noticed several times that a male may also clasp the female slightly with his hind legs when other individuals threaten to break his hold.

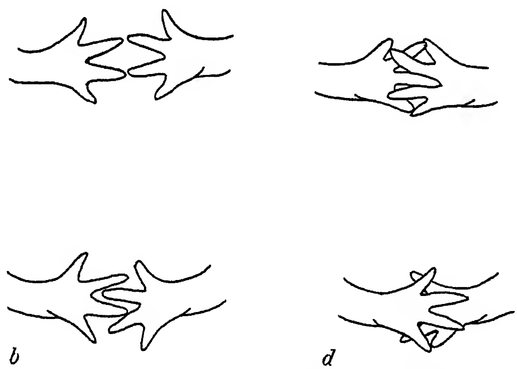


Fig 2. Diagrams of positions of male's forefeet in embrace.

a Digits touching
b Digits alternating
c Digits interlocked.
d One foot over the other

Once the male has established his clasp on the female a variety of events may occur and the embrace may terminate in a few seconds or continue for minutes. Unless the male is sufficiently stimulated to proceed rapidly to the deposition of the spermatophore and the preceding activities there is usually an extended period of interesting "play" when the pair alternately swim about or remain quiescent. Both in-

dividuals have been seen to be active at the same time with their bodies lashing back and forth. Sometimes only the female shows any inclination to move about and she will swim around with the inactive male on her back. The male's efforts are more effective, often lifting the pair to the surface as his body lashes vigorously from side to side. At this point his chin is rubbed persistently over the female's head. Usually the tip of the male's snout is not thrust farther forward than the anterior corners of the female's eyes. However, as the "Liebesspiel" progresses a courting pair is observed to settle quietly and the male gradually works his body forward until his chin is applied to her snout (Fig. 3), and he rubs her excitedly. Sometimes his hind feet appear to stroke her body too. A typical notation gives an accurate idea of this phase:

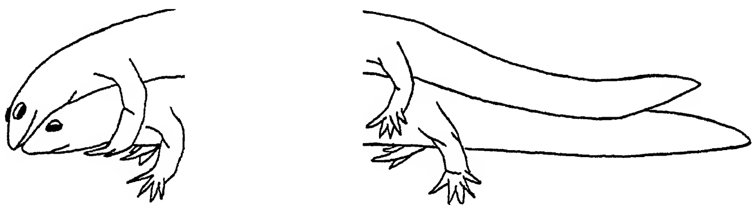


Fig. 3. Second position of male in embrace. Head in position for rubbing female's snout with his chin.

10:10 A.M.—Male embracing female and as he moves forward to rub her snout he slackens his grasp considerably, but when she makes a move as if to escape he tightens it at once.

This stage is usually terminated quickly and the male releases his hold to move forward and ahead of the female. As he proceeds his whole body is tremulous and his tail undulates unceasingly. The vibrating of his body continues and a sort of tenseness appears as his feet are lifted from the bottom and held rigidly outstretched. At the same time his waving tail assumes a position at right angles to his body. Only the tip of his snout and cloaca are in contact with the surface of the aquarium and as the quivering continues he deposits a spermatophore. In the majority of cases a male has been seen to produce two or three spermatophores within a minute or two, about 1.5 cm. apart. It should be noted at this point that the extrusion of spermatophores has seldom been observed when no female is at hand and often the male curtails the process when the female shows indifference or half-hearted interest. In the latter case the male ordinarily returns to embrace her and repeat the rubbing of her snout with his chin.

When the female has been sufficiently stimulated she approaches and attempts to bring her snout to the male's cloaca. This usually results in the male's depositing one or generally several spermatophores. She moves forward with the male as he continues to produce them. Consequently, first her chin and then her body pass over the spermatophore, and if she is undisturbed her cloaca finally settles down upon it. Unfortunately the interference of other individuals or the return of the courting male often ends the story at this point. However, two cases of removal of the spermatophore head were carefully noted. One record is as follows:

10:43 A.M.—Female's cloaca directly over the spermatophore and she rests there with only slight movement of her body. Other individuals approaching move her but not before a considerable portion of the spermatophore head has entered her cloaca.

The one instance of complete engulfment of the spermatophore is recorded as follows:

Male deposits one spermatophore and then a second about 2 cms. before it. Female follows him, nose at his cloaca. Passes her body over first spermatophore and settles cloaca over it. Her body shows slight undulations in pelvic region. Spermatophore picked up in about one minute.

The exact mechanism of the introduction of the spermatophore into the female's cloaca is not definitely determined, but as in *A. maculatum* the cloacal lips appear to be the chief means. Certainly the hind limbs are not used as described by Gasco (1881) for the female axolotl.

The recognition of the female by the male appears to be easily accomplished. Whether it is a matter of attraction effected by odor or an optical or tactile stimulus induced by the size of the gravid individual remains undetermined. Unlike *A. opacum* (Noble and Brady, 1932) the males of *A. jeffersonianum* evince sustained interest only in the opposite sex and the rapidity with which they can determine the head end of the females is very striking. In only a few instances of the great number of embraces that were watched did the male clasp the posterior portion of the female's body and continue to hold her in that manner. Two cases of genuine interest of one male in another were carefully noticed and recorded because, as mentioned above, members of the same sex usually remained indifferent to each other unless a female was involved and both males were striving to dislodge each other and court the female without interference. An embrace of males for a period of one and a half minutes is described in the records.

10:47 A.M.—Two males are nosing each other and one clasps the other around his hind limbs. 10:48—Both clasping. They curl into a wriggling mass, nosing cloacæ.

10:48½—One still holding the other who breaks loose by frantically lashing his body.

A somewhat more interesting observation was made later the same day.

11:18 A.M.—One male attempting to embrace another whom he is holding just before his hind legs. The clasping male is momentarily shaken off but renews his hold now behind the forelimbs. His forefeet are pressed against the protesting individual's body and the digits are clearly interlocked. The salamander being held squirms and writhes and tries to pry off his captor by pushing with his hind feet. This protest continues until he breaks loose at 11:22 A.M.

This record is followed by the note that at

11:23 A.M.—The situation is reversed and the captor now becomes the captive and the activity is again vigorous until 11:24 when a female swims by and the males still in embrace clasp her too.

Possibly the relatively passive reaction of the female to embrace as contrasted with the male's violent avoiding reaction to the same situation serves to guide the courting male to the right sex. However, this cannot be the whole story, for females undesirous of attention were seen to attempt actively to dislodge the unwelcome males who continued to cling tenaciously. Further study along experimental lines will be necessary to clear up this point.

CONCLUSIONS

1.—The courtship of *A. jeffersonianum* as described by Mohr (1931) is confirmed and further details observed.

2.—The male embraces the female from above either before or behind the forelimbs.

3.—The male stimulates the female to sexual activity by undulations of his body and by vigorous rubbing of his chin first over her head and then her snout.

4.—The male when extruding a spermatophore has his feet outstretched and tail raised. His entire body undulates. The female is further stimulated by close application of her snout to his cloaca at the time of deposition.

5.—The female secures the spermatophore with her cloacal lips. She may receive the whole spermatophore but more often removes only the head.

6.—Courting males of *A. jeffersonianum* remain almost completely indifferent to each other except in the presence of a female whom both attempt to embrace.

7.—Two cases of one male embracing another male for a prolonged period are reported.

LITERATURE CITED

GASCO, F. 1881. 'Les amours des axolotls.' Zool. Anz., IV, pp. 313–316, 329–334.

MOHR, CHARLES E. 1931. 'Observations on the early breeding habits of *Ambystoma jeffersonianum* in central Pennsylvania.' Copeia, No. 3, pp. 102–104.

Noble, G. K. 1931 'The Biology of the Amphibia.' New York.

Noble, G. K, and Brady, M. K. 1930 'The courtship of plethodontid salamanders.' Copeia, No. 2, pp 52–54.

1932. 'Observations on the life history of the marbled salamander *Ambystoma opacum* Gravenhorst.' Zoologica in press.

AMERICAN MUSEUM NOVITATES

Number 547 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | July 8, 1932

59.57, 99 (67.5)

RECORDS OF AFRICAN BEES. I

BY T. D. A. COCKERELL

The bees here recorded were for the most part obtained by Messrs. Herbert Lang and James P. Chapin during their famous Congo Expedition (1909–1915).[1] These specimens are in The American Museum of Natural History and my study of them has been facilitated by the further loan from the American Museum of numerous African bees obtained several years ago from Dr. H. Friese. Of course I have referred continually to my own collection, and particularly to the material brought back from the African Expedition of 1931. Types of new species are deposited in the American Museum.

Collectors' names are abbreviated as follows: L. and C. = Lang and Chapin; J.O. = John Ogilvie; L. O. = (Mrs.) Lizzie Ogilvie; A. M. = Alice Mackie; W. P. C. = (Mrs.) W. P. Cockerell; Ckll. = T. D. A. Cockerell.

Nomioides muiri Cockerell

Belgian Congo: Boma, June 18, 1915, ♂ (L. and C.). This seems to be exactly the same as *N. muiri*, generally known as an East African species, but a female specimen is desirable. I have both sexes from Sawmills, S. Rhodesia, Dec. 22, 1928 (Arnold), and it has been collected at Mfongosi, Zululand (Jones), and at Windhoek in S. W. Africa.

In the Cape Province the common *Nomioides* is *N. maculiventris* (Cameron), originally described as a *Ceratina*. We got it at flowers of *Mesembryanthemum* at Whitehill, Nov. 26 (Ckll.), and Colesburg Junction, Oct. 23 (W. P. C.); but it is not strictly oligotropic, as it was found visiting a quite different plant, not identified, at Blaukrans, near Calvinia, Nov. 17 (Ckll.). Another locality is Graaff-Reinet, Oct. 26 (A. M.).

This *N. maculiventris* closely resembles (female) *N. cruciferarum* Ckll. from Morocco, but is easily separated by the conspicuous dark band between the yellow of the scutellum and postscutellum.

The S. African *Nomioides* now before me may be separated thus:

[1]We met Mr. Lang in Pretoria, and had the pleasure of hearing from him many stories of his adventures in the Congo.

1.—Males. . . . . 2.
Females. . . . . .3.
2.—Abdomen rather broad, without light markings; tibiæ and tarsi clear yellow (Port Elizabeth, Oct. 29, J. O.). . . . . *N. halictoides* Blüthgen.
Abdomen rather long and narrow, with yellow bands on tergites 2 and 3; first tergite blue. . . . . *N. muiri* Cockerell.
3.—Scutellum dark green; abdomen with light yellow bands, and a spot on each side of first tergite (Doorn River, near Camfer, Nov. 3, A. M.). *N. capensis* Blüthgen.
Scutellum yellow. . . . . .4.
4.—Yellow of scutellum deeply notched in front; postscutellum yellow. *N. muiri* Cockerell.
Yellow of scutellum not at all notched. . . . . *N. maculiventris* (Cameron).

N. muiri was described by Friese as *N. fasciatus* Friese, but that is really another species, found in Egypt, Sudan, and Algeria. Blüthgen treats *N. muiri* as a race of the Palæarctic *N. variegata* (Olivier) and refers *N. maculiventris* to the Palæarctic *N. facilis* (Smith). I prefer to treat them as distinct species, but there may well be legitimate differences of opinion.

Gronoceras tricolor (Friese)

Belgian Congo: Medje, April–May, 1910, ♂ (L. and C.); Poko, Aug. 13 (L. and C.); Stanleyville, April 7 and 27, 1915 (L. and C.).

Gronoceras benguellensis Cockerell

Belgian Congo: Banana, Aug., 1915 (L. and C.).

Gronoceras cincta (Fabricius)

Belgian Congo: Faradje, Nov., 1912 (L. and C.).

Megachile rufipes (Fabricius)

Belgian Congo: Boma, June 14, 1915 (L. and C.). Scape partly red.

Megachile rufipes xanthoptera (Schletterer)

Belgian Congo: Poko, Aug., 1913 (L. and C.).

Megachile pachingeri Friese

Belgian Congo: Stanleyville, April 12, 1915 (L. and C.).

Megachile torrida Smith

Belgian Congo: Banana, Aug. 15 (L. and C.).

Megachile bituberculata Ritsema

Belgian Congo: Stanleyville, April 10, 1915 (L. and C.); Tshibinda, Aug. 25 (W. P. C.); Dilolo, July 25 (J. O.); Tenke, Aug. 1 (J. O.); Poko, Aug., 1913 (L. and C.). The variety *mediocana* Cockerell, with hair

of metathorax and base of abdomen white, was taken at Tshibinda and Dilolo. At Tshibinda both the typical form and the variety *mediocana* were taken, the latter being (at least in that locality) no more than an individual variation.

Megachile clypearis Friese

Belgian Congo: Stanleyville, April 30, 1915 (L. and C.).

Megachile crocutella Cockerell

Belgian Congo: Stanleyville, April 4–17 (L. and C.); Gamangui, Feb., 1910 (L. and C.); Akenge, Oct., 1913 (L. and C.). Compared with *M. crocuta,* the described difference in the mesothorax stands, but one is large (about 14 mm. long), and some show a very narrow shining edge to clypeus. I am by no means sure that this is not the female of *M. crocuta,* after all.

Megachile crocuta Schletterer

Belgian Congo: Stanleyville, April 27, 1915 (L. and C.).

Megachile obtusodentata Friese

Belgian Congo: Stanleyville, April 2, 1915 (L. and C.).

Megachile rhodesica Cockerell

Belgian Congo: Libenge, Ubangi District (H. Schubotz). Sent by Friese as *M. venusta* Smith. The real *M. venusta* was taken in the Cape Province: Calvinia, Nov. 11 (J. O.); Doorn River, Nov. 3 (L. O.); Nieuwoudtville, captured by a thomisid spider (W. P. C.); and in the Transvaal: Wonderboom, near Pretoria, Oct. 4 (J. O.).

Megachile ancillula Vachal

Belgian Congo: Stanleyville, April 15 and 19 (L. and C.); Faradje, March 30, 1912 (L. and C.).

Megachile claribasis, new species

Female.—Length about 18.5 mm., anterior wing 13.3; black, including mandibles, antennæ, tegulæ, and legs; wings with nearly the basal half hyaline, slightly yellowish, the apical half (beginning at level of apical part of first cubital cell) dark fuliginous, shining violaceous; head rather large, facial quadrangle about as broad as long; eyes brown; mandibles very broad, with two apical teeth, and a long cutting edge which is first strongly convex and then (toward the inner angle) concave; clypeus short and broad (but not as in *Eumegachile*), convex, densely and roughly punctured (the punctures of different sizes), the upper half with a median shining raised band, the apical region depressed, the margin smooth, with slight elevations at sides, but no definite tubercles, and no median emargination; supraclypeal area finely and closely punctured all over; cheeks with a sharp edge behind; hair of head mostly short and black, dense at sides of face and on front; a little patch of light hair next

to upper part of clypeal margin on each side; a tuft of pale, fulvous-tinted hair between antennæ; lower part of cheeks with much pale hair, but black on lowest part; hair of mesothorax and scutellum short, very thin, and black; a little pale hair on middle of mesothorax anteriorly; metathorax with copious white hair; tubercles with pale fulvous hair, contrasting with the black in front of them; hair of mesopleura and under side of thorax pale, silky, fulvous-tinted; mesothorax anteriorly dull, with dense small punctures, but the posterior half polished, with the punctures well separated; axillæ swollen, the elevated part smooth and shining, the outer face with dense black hair; scutellum convex, anteriorly shining and impunctate, posteriorly rough and dull; tegulæ large, densely and minutely punctured, seen from in front showing a small shining eminence; basal nervure falling just short of nervulus; second cubital cell long; legs with thick broad basitarsi, anterior ones with more or less pallid shining hair on outer side, but very dark reddish on inner (the second joint on inner side with a fringe of copper red); middle basitarsi on outer side with dense shining creamy-white hair; hind tibiæ with white hair, clear and bright on inner side; hind basitarsi flattened, as broad as tibiæ, longer than the other joints together, the hair on the inner side very dark rusty brown, on the outer thin and white; abdomen with small weak punctures, more than apical half of second tergite (bounded by a sharp rim) practically impunctate; sixth tergite in profile slightly concave; first tergite above with thin white hair, but sides with large, dense, pure white patches; tergites 2 to 5 also with dense, pure white hair-patches, successively smaller, but no bands; ventral scopa white at base, then fulvous, but black on the last three sternites.

Belgian Congo: Stanleyville, April 30, 1915 (Lang and Chapin). This species illustrates very well the difficulty of defining subgenera of *Megachile*. In many respects it resembles *M. adeloptera* Schletterer, but it has swollen shining axillæ as in the subgenus *Amegachile* of Friese. Yet the clypeal structure is not that of typical *Amegachile*. There is some resemblance to *Megachille lineolata* Ckll., especially in the pubescence, but that has the ventral scopa all black, and differs in the clypeus and mandibles. The general appearance and color of the wings suggest *M.* (*Amegachile*) *geoffrei* Ckll., but that is smaller, with emarginate clypeus, red tegulæ and legs.

Megachile boswendica Cockerell

Belgian Congo: Tshibinda, Aug. 24 (W. P. C.).

Megachile (Eumegachile) montibia Strand

Belgian Congo: Tshibinda, Aug. 29 (W. P. C.).

Lithurgus sparganotes Schletterer

Belgian Congo: Stanleyville, April 9, 1915, ♀ (L. and C.).

Heriades (Noteriades) tricarinatus (Bingham)

Belgian Congo: Faradje, Oct., 1912 (L. and C.).

Ctenoplectra rodhaini Cockerell

Belgian Congo: Faradje, Nov., 1912 (L. and C.).

Crocisa delumbata Vachal

Belgian Congo: Boma, June 17, 1915 (L. and C.). Boma is the type locality. The specimen is considerably larger than Vachal indicates, anterior wing 12 mm.; the markings are very pale blue. It is a male, and in Meyer's key runs exactly to *C. delumbata.*

Crocisa chapini, new species

MALE.—Length about 10 mm., anterior wing 9; markings white; scutellum with two large spots, a white fringe under the incision; sternites 2 to 4, but not 5, with lateral white spots. In Meyer's table this specimen runs exactly to *C. tschofferi* Vachal, but it lacks the middle spot on scutellum, and the lateral discal spots on mesothorax are small, so that the distance from one either to the central band or to the marginal band is greater than its diameter. The posterior marks on mesothorax are transverse, not elongated anteriorly. The interrupted abdominal bands are as in *C. tschofferi*, but considerably narrower than in *C. braunsiana* Friese, which Meyer treats, I believe erroneously, as a synonym of *C. tschofferi.* In most respects the insect is exactly like *C. braunsiana*, a species of South Africa. It shows very well the two little bare, shining black triangles at the middle of front of mesothorax, which are so characteristic of *C. braunsiana* but are wanting in *C. tschofferi.*

Belgian Congo: Boma, June 17, 1915 (L. and C.). The original *C. tschofferi* came from Boma; my specimen, which agrees with the description, is from N. E. Rhodesia. There is a possibility that the present insect is a variety of *C. tschofferi*, and the Rhodesian one distinct, but so far as I can judge from the literature, the interpretation given is correct. It is remarkable that insects from such totally different environments as Boma and Willowmore should be so much alike.

Crocisaspidia maculata (Friese)

Belgian Congo: Faradje, Nov. 12 (L. and C.)

Nomia notabilis Schletterer

Belgian Congo: Stanleyville, April 13, 1915, ♂ (L. and C.); The specimen is peculiar for the red hind basitarsi, thus showing an approach to *N. bicornigera* Strand, which seems to be only a race of *N. notabilis.*

Nomia speciosa Friese

Belgian Congo: Kinshasa, June 1, 1915 (L. and C.); Elisabethville, Sept. 15, ♀ (W. P. C.). In the Kinshasa specimen the upper part of clypeus has a smooth shining band, and the supraclypeal area is dull. In the Elizabethville specimen the clypeus lacks this band, and the supraclypeal area is shining in middle. I believe these differences are merely individual.

Nomia elephas Strand

In the American Museum is a type of *N. albocærulea* Friese, female, from Kigonsera. The species was published by Strand as *N. elephas*, and Friese's description did not appear, though the name he gave has been cited. From Kafubu Mission, Katanga, Sept. 19 (A. M.), I have what I can only consider the hitherto unknown male of this species. The face is densely covered with cream-colored hair; flagellum long and slender, simple, ferruginous beneath; thorax above with abundant, gray hair, and black hairs intermixed; second cubital cell, as in female, is strictly parallel-sided, higher than long, receiving recurrent nervure about middle; legs black, small joints of front tarsi red, of the others, which are elongated, pale yellowish with dusky tips; hind femora slender, in lateral view almost parallel-sided, basal half beneath with short stiff white hair; hind tibiæ normal, broadened apically; abdomen with first tergite evidently punctured and shining, black parts of the others dull and not evidently punctured; pallid apical depressions as in female, except that they are about twice as broad, and the first is orange, the second and third strongly flushed with orange basally, the bands otherwise are pale grayish; venter clear red, fourth sternite broadly whitish apically; two brushes of long white hair subapically beneath.

In Strand's table this species runs nearest to *N. stylopicata* Strand, which according to Hedicke is the same as *N. somalica* Friese. However, this is a very different species.

Nomia langi, new species

MALE.—Length about 9 mm., anterior wing 7.4; black, rather slender, head and thorax with pale yellowish-tinted pubescence, dense and glittering on face, very thin and short on thorax above; eyes dark brown; face broad; mandibles entirely black; antennæ long, black; mesothorax entirely dull seen from the front, but posteriorly punctured and shining; scutellum dull, not evidently bi-gibbous; postscutellum densely hairy; base of metathorax with a broad shining coarsely ridged transverse area; tegulæ small, mainly black, outwardly rufous; wings dilute reddish fuliginous, the apical margin rather darker, more dusky and less red; basal nervure falling just short of nervulus; second cubital cell large and broad, receiving recurrent nervure toward the end; legs mainly black, but tarsi and front and middle tibiæ at apex rufous, hind tibiæ entirely red, except an elongated blackish shade on outer face; hind trochanters with a small tooth; hind femora only moderately enlarged, with a strong tooth beneath toward end; hind tibiæ robust but simple, a slight swelling on inner side where there is a tooth in some species; abdomen very finely and densely punctured, the first two tergites brownish; tergites with pallid hind margins, on which are broad bands of dull white hair; venter shining, with clear white tegumentary bands on sternites three and four.

Belgian Congo: Stanleyville, April 17, 1915 (L. and C.). A species of rather ordinary aspect, belonging with *N. welwitschi* and *N. rubripes* in a group with dull mesothorax. The three males may be separated thus:

1.—Hind femora black, much less robust .... *langi* Ckll.
Hind femora red or largely so, much more robust. .... 2.
2.—Tegulæ dark.......... *welwitschi* Ckll.
Tegulæ clear red.......... *rubripes* Friese.

Nomia cinerea Friese

Cape Province: Calvinia, Nov. 12 and 14, ♀ (A M.); foot of Van Rhyn's Pass, Nov. 21, ♂, ♀ (A. M., J. Jooste); Graaff-Reinet, Oct. 25, ♂ (Ckll.); Blaukrans, near Calvinia, Nov. 17, ♂ (J. O.). One of each sex has been placed in the American Museum. Friese knew only the male.

Nomia (Stictonomia) amoenula stanleyi, new subspecies

Male.—Length about 6 mm., anterior wing 5; black, robust, the pubescence pale ochreous; head broad, orbits strongly converging below; face densely covered with light yellow hair; tongue short, dagger-like; antennæ long, reaching scutellum, flagellum ferruginous beneath; front dull, vertex glistening; mesothorax moderately shining, with dense fine punctures and sparse large ones, anterior half or more with thin fulvous tomentum, but fulvous hair dense on upper border of prothorax and tubercles; the dense fulvous hair also tends to form two spots on anterior border of mesothorax; scutellum with two long sharp spines; area of metathorax with a narrow shining channel crossed by fine plicæ, not very closely set; a sharp keel at each side of lower half of posterior face of metathorax; tegulæ very large, expanded posteriorly, bright apricot color with paler margins; wings dusky hyaline, brownish apically; stigma large, dark reddish; basal nervure strongly arched, meeting nervulus; second cubital cell about square, first recurrent nervure meeting second intercubitus; legs black, with pale fulvous-tinted hair, tarsi brownish, the anterior and sometimes also the middle tarsi clear red; hind legs simple, the femora slender; abdomen broad, with basal and apical bands of ochreous-tinted hair; first tergite with apical band represented only at sides, but with also a patch of pale ochreous hair on each side of disc; first tergite polished, with sparse very large punctures, running more or less in transverse rows; second tergite with similar but smaller punctures; third with still smaller. The first recurrent nervure varies in position.

Belgian Congo: Stanleyville, April, 1915 (L. and C.). I should have supposed this to be the imperfectly described *N. atrinervis* Vachal, but the nervures are brown, certainly not black. From the wide distribution cited by Vachal for his *N. atrinervis*, and the wide range of measurements (wing, 4.5 to 7 mm.), I infer that his series was probably composite. Libreville may be designated as the type locality.

Nomia (Stictonomia) amoenula aloëphila, new subspecies

Male.—Anterior wing 4.5 mm.; in all respects closely allied to the last, but differing thus: tegulæ with the elevated portion dark reddish brown, the margins

whitish; hair of face creamy white; thorax above rather more covered with fulvous tomentum; first recurrent nervure reaching second cubital cell an appreciable distance before the end. The apex of the abdomen, with a broad dentiform lobe on each side and orange hair between, is as in *N. amoenula stanleyi.*

FEMALE (Type).—Length a little over 5 mm., anterior wing 4.7; face very broad, with thin dull white hair; face and front very densely punctured, the front becoming striate; clypeus shining; flagellum short, obscurely reddish beneath; scutellum without distinct elevations; elevated part of tegulæ practically black; postscutellum densely covered with tomentum; hair-spots at sides of first tergite very distinct; legs black, the small joints of tarsi reddish.

Belgian Congo: type locality (♀), 77 kilom. south of Bukavu, at flowers of *Aloe,* Aug. 28 (W. P. C.); Stanleyville, Feb., 1915, ♂, March, 1915, ♀ (L. and C.). I had sorted this out from *N. amoenula stanleyi* as a certainly distinct species, but the males agree so exactly in structure that I cannot see more than racial difference. The character of the position of the first recurrent nervure is variable and cannot be used to separate two species. The female has of course no scutellar spines. Strand published a good table for female bees of this alliance, with very large tegulæ, which may be abbreviated as follows:

1.—First tergite with a pair of hair-spots; postscutellum densely tomentose.....2.
First tergite without such hair-spots; postscutellum thinly haired.
N. schubotzi Strand, *N. patellata* Magretti, and *N. corruscatrix* Strand.
2.—Tergites with basal hair-bands..3.
Tergites with only apical hair-bands.
N. interstitinervis Strand and *N. latipes* Morawitz.
3.—Stigma yellow; species about 7 mm. long......................... ....4.
Stigma black; species often smaller...... ....5.
4.—Mesonotum dull..............................*N. anthidioides* Gerstaecker.
Mesonotum strongly shining.
N. ruficornis Spinola, *N. tegulata* Smith and *N. oxybeloides* Smith.
5.—Vertex shining; veins black............................*M. garua* Strand.
Vertex minutely reticulate (really very densely punctured); veins brown.
N. amoenula Gerstaecker.

The black veins of *N. garua* suggest Vachal's *atrinervis*, and Strand, when describing, added (*atrinervis* Vachal ??). It appears, however, that *N. garua* has dark tegulæ, while *atrinervis* is said to have them red. Our female runs best to *N. amoenula,* agreeing in the vertex, but differing in the dark, obscurely reddish flagellum, that of *N. amoenula* being very bright red beneath except at base. Male *N. amoenula* has the abdomen more or less red.

From all the above I can only infer that there is a wide-spread species, *N. amoenula* (which runs into various subspecies or races),

which may perhaps be addicted to particular flowers. I have named the two forms before me in accordance with this idea.

Nomia austrotegulata, new species

FEMALE.—Length about 8 mm.; face very broad, with white hair; flagellum red beneath; vertex very densely punctured; a band of very dense pure white hair along front of mesothorax and entirely covering tubercles; pleura with dense white hair; a narrow band of white tomentum in front of scutellum, and postscutellum covered with the same; mesothorax highly polished, with scattered large punctures; scutellum with smaller punctures; channel at base of metathorax extremely narrow, with cross-ridges, the large triangular space below it highly polished; tegulæ very large, reddish white, with a brown spot; wings clear hyaline, with light orange stigma; second cubital cell about square; first recurrent nervure reaching extreme basal corner of third cubital cell; all the tarsi, hind tibiæ, and anterior tibiæ in front, bright red, middle tibiæ a little dusky, and covered with white hair; hind basitarsi very broad, with a shining pale yellowish apical brush; abdomen with a broad band of hair across first tergite and basal and apical bands on the others; hair of fifth tergite suffused with light red; first tergite with the raised portion beyond the band narrow, smooth and shining in middle, on each side broadening to admit a series of punctures between two ridges; venter rufous.

Cape Province: Willowmore, Dec. 15, 1901 (Brauns). Sent to the American Museum by Dr. Friese as *N. tegulata* Smith, and runs exactly to that in Strand's table. However, it is not the genuine *N. tegulata*, the type of which came from Sierra Leone, and has subhyaline wings, more fuscous toward apex, and metathorax dull. It is close to *N. anomala* Kirby, *N. duplocincta* Sichel, and *N. magrettii* Gribodo. Compared with *N. anomala*, the nervures are paler, the stigma is lighter and more orange, not dark-margined. It is a typical desert bee.

Nomia hadrosoma, new species

FEMALE.—Length about 6 mm., anterior wing 5.7; black, robust, mandibles entirely black; the short thick flagellum obscurely rufescent beneath, especially toward end; face very broad, with dull white hair at sides; clypeus closely punctured, the punctures running in lines; vertex mostly dull, but shining between ocelli; mesothorax and scutellum dull, with dense minute punctures and scattered large ones (weak on mesothorax); postscutellum with dense white tomentum on basal half, not always apparent; basal channel of metathorax about half as wide as postscutellum in middle, dull, with very feeble, hardly noticeable sculpture; tegulæ very large, the elevated portion pure black, the flat portions dull white; wings conspicuously dusky, especially in the apical field; stigma rather large, dusky brown; nervures brown; basal nervure meeting nervulus; second cubital cell about square, or somewhat narrowed above; first recurrent nervure meeting second intercubitus; legs mainly black; anterior and middle tibiæ each with a conspicuous tuft of red hair in front; hind tibiæ and basal half of basitarsi light ferruginous; abdomen stout, with basal and apical pale cinereous hair-bands; first tergite shining, with no evident punctures (the microscope shows scattered punctures toward the base), with some pale hair

at sides, but no apical or discal band, nor any spots such as occur in related species; apical band of fourth tergite very broad, dense and white; fifth with gray hair, white on the margin.

Belgian Congo: Dilolo (type locality), July 24 and 25, 3 ♀ (J. O.); Tshibinda, Aug. 26 (A. M.) Larger than the *N. amoenula* forms, mesothorax pruinose at anterior corners, scutellum with scattered punctures. By the coloration of the hind legs it suggests *N. diducta* Vachal, from Somaliland, but that has clear wings and yellow nervures. A cotype has been placed in the American Museum.

Nomia rubra Friese

I have before me, from the American Museum, one of Friese's series, a female from Ikutha, British E. Africa. *N. rubra* was primarily based on the male. from Shilouvane, N. Transvaal. In 1916, Meade-Waldo briefly indicated some characters of *N. strenua* Cameron MS., in a table. In 1920, I described what I took to be this *N. strenua* from Natal. Whereupon Dr. Hans Brauns wrote that he had both sexes of *N. rubra* Friese, from Bulawayo, S. Rhodesia and Warmbad, Transvaal, and that my *N. strenua* was only a geographical race of it, with no structural differences at all. Now I have from the British Museum a male *N. strenua* from Lonely Mine, Matabeleland (Dr. H. Swale), one of the specimens used by Meade-Waldo, and it has a bright red abdomen, and appears to be the genuine *N. rubra* Friese. But the female *N. rubra* from Ikutha is a distinct race or even species and, as my Natal insect is not the real *N. strenua*, two new names are required, as follows:

Nomia rubra atricauda, new subspecies

Nomia strenua Cockerell, 1920, Annals Durban Museum, II, p. 293, ♂, ♀. Durban, Natal.

The form with dark abdomen. Structurally, as Brauns stated, it closely agrees with the red abdomened *N. strenua*, which I take to be *N. rubra*. In my specimen of the latter, however, the first recurrent nervure joins the second cubital cell slightly before the middle, whereas in the Durban insect it joins it well beyond the middle. The male is the type.

Nomia rubra politissima, new subspecies or species

The female from Ikutha, with shining very bright red abdomen, differs structurally in the abdomen, the first two tergites being smooth, hardly at all punctured, instead of densely punctured. The basal nervure meets the nervulus, and the square second cubital cell, quite as broad as high, receives the recurrent nervure near its end. The mesothorax is more shining, and much less coarsely and densely punctured. The tegu-

læ, the hair on face, and the characteristic pubescence of the front legs do not differ.

Nomia granulata Vachal

Belgian Congo: Stanleyville, April, 1915, ♂ (L. and C). The two little processes on the third sternite, mentioned by Vachal, are very apparent.

Nomia patellifera Westwood

Belgian Congo: Stanleyville, five taken in April (L. and C.); Katanga Mission, Sept. 17 (L. O.).

Nomia montana (Friese)

One of Friese's types is in the American Museum; it is a female, with the shining tegulæ almost black; stigma small, dark reddish; second cubital cell very broad, wings dilute fuliginous; abdomen with pure white hair-bands on tergites three and four, and at sides of one and two, hair at apex red. Hott-Holl Mts., 4000 ft. Friese described this as a variety of *N. burorum* Friese, but it is certainly a distinct species. The assigned male is perhaps not conspecific; I designate the female, on which the main description is based, as the type.

N. nudiventris Friese, which Friese considered allied to *N. burorum*, is easily separated from the members of that group by the transverse channel at base of metathorax broadened in middle and angulate posteriorly, abruptly contrasting with the dull metathorax below. The tegulæ are black, the wings brown.

Nomia burorum Friese

A male type from Sunday River (Dr. Brauns) has the mandibles red, black at end; face very broad, its hair clear white; tegulæ light rufo-fulvous: hind femora with a strong tooth beneath toward end; fourth sternite with a pair of strong converging ridges. *N. fulvipes* Friese (I have one of Friese's specimens, from Bothaville, O. F. S., taken by Dr. Brauns) is extremely close to *N. burorum*, and has the toothed hind femora. However, the male flagellum is shorter, the joints are broader than long, but in *N. burorum* they are conspicuously longer than broad.

Nomia dominarum, new species

MALE.—Agrees with *N. burorum* in nearly all respects, but still is easily separated by the hind femora having no tooth below, but at most a very slight angle, and the mesothorax being entirely dull, without evident sculpture, whereas in *N. burorum* and *N. fulvipes* it is strongly punctured, and shining between the punctures. The two converging ridges on the fourth sternite are very strong and distinct. Tegulæ pale testaceous; wings yellowish, with the broad margin very dark; basal nervure

only gently arched, meeting nervulus; stigma red, rather large; second cubital cell very broad, receiving recurrent nervure far beyond the middle; hair of face white; antennæ rather long, flagellar joints longer than broad; tibiæ and tarsi, femora at apex, and stripe beneath anterior femora, red, but black stains on middle and hind tibiæ; fourth tergite before the pale band elevated, appearing dentiform in lateral profile, but more or less excavated or depressed in middle, between two little shining elevations. The size varies; anterior wings 8.2 to 9 mm.

Cape Province: Lady Grey (type locality), 4 ♂, Dec. 8, 1924, Jan. 29, 1925, Feb. 13, 1925, all collected by R. I. Nel, and sent by the Imperial Institute of Entomology. Natal; Greytown, Oct. 20 (A. M.). The Greytown one has the head shorter and the face proportionately broader.

Differs from *N. nubecula* Smith by the black antennæ, non-tuberculate scutellum, and lack of fulvous pubescence. In Strand's table it falls nearest to *N. kigonserana* Strand, but the hind tibiæ and tarsi are red, not yellow, the flagellum is black, and the insect is larger. A cotype has been placed in the American Museum.

Nomia nigripes (*N. burorum* var. *nigripes* Friese), male with black legs and no converging ridges on fourth sternite, must also be a distinct species, but I have not seen it.

Ceratina ruficauda, new species

FEMALE.—Length fully 11 mm. (a little over 12 with head thrust forward), anterior wing 8.5; densely punctured, head and thorax pure black, abdomen clear bright ferruginous, with first tergite and sides of second black, and the hind margins of the tergites narrowly dark red; legs black, with reddish hair, middle femora angulate beneath; wings fuliginous, pallid basally. Head and thorax practically nude; labrum black, rugose; clypeus high, coarsely longitudinally striate, with a broad reddish yellow transverse apical bar, and on each side there is a semicircular mark of the same color next to the base of the lateral lobe of the clypeus but not on the clypeus; vertex with excessively large punctures, a shining spot behind ocelli; antennæ black; mesothorax and scutellum with large punctures, but not so large as on vertex; basal nervure falling short of nervulus; tegulæ small, reddish black; base of metathorax dull; abdomen closely punctured, hardly shining; venter black at base, and with black bands.

Belgian Congo: Malela, 6° S, 12° 40′ E, July, 1915 (L. and C.). A very distinct species, to be compared only with the much smaller (7.5 mm., wing 6 mm.) *C. allodapoides* Strand, from Uelleburg.

Ceratina viridis Guérin

Belgian Congo: Stanleyville, Apr. 17, 1915, ♀ (L. and C.); Malela, July 5, 1915 (L. and C.). These are smaller than usual, and the Stanleyville one has the apical half of abdomen strongly flushed with blue. *C. congoënsis* Meunier may have been composite, but the typical female had

no clypeal spot. It is supposed to differ structurally by having a keel on tergite six. I feel sure that this was the sulcus which can be seen in *C viridis*, and can be mistaken for a keel.

Allodape langi, new species

FEMALE.—Length 9 mm.; head and thorax black, with dull yellow markings, consisting of a rather narrow median stripe the whole length of clypeus, broadly triangular supraclypeal mark, small bands bordering lateral lobes of clypeus, bands along anterior orbits are broad below, curved inward above, two small bars below middle ocellus, band on cheeks (the lower half mostly reddish brown, the yellow there tapering to a fine point), upper border of pronotum, end of tubercles, two narrow stripes on the shining disc of mesothorax (at posterior end enlarged and somewhat bifid), lateral margins of mesothorax, continuing on to axillæ, posterior half of scutellum, and postscutellum; labrum coarsely rugosopunctate, obscurely reddish; mandibles reddish yellow, dark at apex; lower end of cheeks, next to mandibles, produced into a small black tubercle; each side of vertex with a concave shining area; antennæ black, flagellum with a faint brownish tinge beneath; base of metathorax dull, but with a shining margin; mesopleura hairy; tegulæ pale testaceous; wings dusky hyaline, distinctly brownish; stigma large but narrow, red with a black margin; nervures mostly dark, but the recurrents and the outer intercubitus thin and pale; first recurrent nervure far from base of second cubital cell; legs black, knees narrowly rufous, small joints of tarsi all red, front tibiæ red anteriorly, middle and hind tibiæ rufous at apex; hair on inner side of middle tarsi extremely bright red; scopa of hind legs pale red, with a deep red spot on middle of hind margin of tibiæ; abdomen with first tergite pale red, with a large cream-colored spot at each hind corner; second tergite pale red, with a narrow dull yellow band at extreme base, and a large black spot on each side, some distance from margin; tergites 3 to 6 black, with the extreme base abruptly light yellow, the pale band broadening in middle on 4 and 5, and on six very broad, but not reaching sides; venter red at base, otherwise mainly black.

Belgian Congo: Stanleyville, April, 1915 (L. and C.). Allied to *A. macula* Strand, but that is much smaller. Also to be compared with *A. abdominalis* Brauns and *A. exoloma* Strand, but easily distinguished by the pattern of the abdomen.

Allodape chapini, new species

FEMALE.—Length about 7.5 mm.; head and thorax black, yellow and dark red; the yellow markings consist of an obscure spot at apical middle of clypeus (its lower portion shining and reddish), bands along inner orbits (the part opposite clypeus broad, the upper part very narrow, diverging a little from eye at upper end), bands along posterior orbits (broad above, coming to a point below), broad bow-shaped band on scutellum (posteriorly emarginate in middle), margin of pronotum, and margin of tubercles (indistinctly); postscutellum with an obscure yellowish band; the dark red parts are labrum, mandibles (except end), cheeks (except yellow stripe), mesopleura and metathorax; scape short, with red spots at base and apex; flagellum black, very faintly brownish below; tegulæ hyaline in front, posteriorly light red; wings hyaline; stigma very large, rufofulvous; lower section of basal nervure arched, falling considerably short of nervulus; second cubital cell considerably shorter than in

A. langi, with the face on marginal cell much shorter; legs brownish red, or reddish brown, front femora with a yellow stripe beneath, failing basally; abdomen broad, dull light red, fourth and fifth tergites broadly dusky at sides of base, sixth black; venter dusky red.

Belgian Congo: Malela, July 5, 1915 (L. and C.). In Strand's table falls near *A. exoloma* Strand, which is larger, and has a yellow stripe on clypeus, and the legs mainly black. It may also be compared with the still larger *A. mucronata* Smith, from the Cape. The red abdomen separates it from *A. scutelligera* Strand.

Allodape equatorialis, new species

MALE.—Length about 5 mm.; shining black, with clypeus (constricted below middle), very small lateral marks (next to clypeal constriction), large mark on base of mandibles, stripe on scape, and tubercles (but not upper border of pronotum) of a very pale yellow or cream-color; labrum black; tegulæ very dark brown; wings hyaline and iridescent; stigma large, dark sepia; second cubital cell receiving first recurrent nervure close to base, and second a little more remote from apex; all the tarsi pale yellowish stained with reddish. Very close to *A. facialis* Gerstaecker, with the same large eyes and produced clypeus, but *A. facialis* has black mandibles and a smaller, paler, stigma. It also resembles *A. albitarsis* Friese and *A. progonia* Strand.

Belgian Congo: Stanleyville, March, 1915 (L. and C.).

Anthophora plumipes (Fabricius)

Belgian Congo: Elisabethville, Sept. 11, ♀ (J. O.); Tenke, July 30 and Aug. 1, ♂ (J. O.); Dilolo, July 26, ♂ (Ckll.). The female is exactly like one from Zanzibar (Hildebrandt). The males differ from the type in having only a very minute light mark on scape.

Anthophora nigroclypeata Friese

Belgian Congo: Garamba, July, 1912, ♂ (L. and C.). The male of this species has not been described. The face-markings are creamy white; a very broadly triangular supraclypeal mark, V-like lateral marks, a broad band across lower margin of clypeus, broadest in middle, and connecting with the vertical band, which narrows to a point at top of clypeus; labrum, except the usual basal spots, and mandibles, except apically, also are white; clypeus very prominent; antennæ black; femora obscurely reddish.

Anthophora rubricans, new species

FEMALE.—Length about 11.5 mm., anterior wing 8; black, very robust; head and thorax above with light red hair profusely mixed with black; front with pale fulvous hair, but a tuft of black between antennæ; pure white hair at each side of clypeus and on cheeks; bright red hair on upper part of sides of thorax, but white below; metathorax with light red hair; yellow face-marks consisting of broad triangular supraclypeal mark, narrow median stripe on clypeus, apical corners of clypeus (in some

specimens with an entire narrow marginal band, connecting with vertical stripe), stripes along sides of clypeus, large mark on base of mandibles, and labrum except lateral corners and rather broad upper margin; a shining tubercle at each side of upper part of labrum; antennæ entirely black; tegulæ bright ferruginous; wings dusky, with dark nervures, second cubital cell strongly contracted above; legs black, with mostly red hair, a white fringe behind anterior femora; middle tibiæ on inner face with a specialized bare hollowed black area; middle basitarsi with a stiff brush of pure white hair along posterior margin; hind tibiæ and basitarsi with very bright red hair on both sides, but a white fringe posteriorly on tibiæ; basitarsi with a large black brush at apex; abdomen with four broad very bright ferruginous bands of appressed hair; first two tergites with black hair on disc, next two with partly black and partly light; apex with a very large black patch, the margin on each side of it with a fringe of long pure white hair; venter with dark red hair, but extreme margins of tergites with white.

Cape Province: top of Van Rhyn's Pass, Nov. 19 (W . P. C.), type; Nieuwoudtville, Nov. 18 (J. O.); Uitenhage, Oct. 30 (J. O.); near Oudtshoorn, Nov. 1, (A. M.); Doorn River, near Camfer, Nov. 3 (A. M.). Looks like *A. capensis* Friese, but easily known by the pure black hair on second tergite before the band, and the color of hair on hind legs. A cotype has been placed in the American Museum.

Anthophora cincta (Fabricius)

Belgian Congo: Malela, 6° S., July 9, 1915 (L. and C.). One of each sex; the male has the mesothorax shining posteriorly, the female has it dull.

Anthophora albocaudata Dours

Belgian Congo: Stanleyville, Feb., 1915, ♀ (L. and C.).

Anthophora advena Smith

Belgian Congo: Dilolo, July 25, ♂ (J. O.).

Anthophora advenula Cockerell

Belgian Congo: Stanleyville, April 4, 1915 (L. and C.). In my original description, for length 9 to 10 mm., read length 14 to 15 mm.

Anthophora latipes Friese

Belgian Congo: Katanga Mission, at flowers of *Melastoma*, Sept. 17 (Ckll.).

Anthophora vestita Smith

Female with clypeus entirely black, Nieuwoudtville, Cape Province, Nov. 22 (J. O.). With a yellow band along lower margin of clypeus. Uitenhage, C. P., Oct. 30 (W. P. C.); near Oudtshoorn, C. P., Nov. 1 (Ckll.); Greytown, Natal, Oct. 20 (W. P. C.).

Anthophora labrosa Friese

Cape Province: Nieuwoudtville, Nov. 19 (A. M.), Nov. 20 (W. P. C.). Differs a little from description in having no yellow marks on base of labrum, and tarsi pale-haired.

Anthophora niveata Friese

MALES.—(1.) Clypeus with two well-developed black discal bars. Cape Province: Van Rhyn's Pass, Nov. 11 (J. O.); Calvinia, Nov. 16 (A. M.).

(2.) Clypeus with only faint traces of bars. Cape Province: Graaff-Reinet, Oct. 22 (J O.); top of Van Rhyn's Pass, Nov. 19 (Ckll.).

FEMALES.—(1.) Lower margin of clypeus with a transverse band, but the longitudinal mark is truncate below, and does not reach it. Van Rhyn's Pass, C. P., Nov. 11 (J. O.).

(2.) Marginal band on clypeus joining vertical one. (2*a*.) Rich fulvous hair on thorax posteriorly. Calvinia, C. P., Nov. 14 (A. M.). (2*b*.) No fulvous hair on thorax posteriorly. Cape Province: Calvinia, Nov. 12 (J. O.), Nov. 13 (W. P. C.); Whitehill, Nov. 26 (J. Archer); Graaff-Reinet, Oct. 25 (Ckll.); Blaukrans, Nov. 17 (L. O.).

Anthophora circulata (Fabricius)

MALES.—(1.) Flagellum with the red dark. Belgian Congo: Dilolo, July 23 (J. O.).

(2.) Flagellum clear red beneath. (2*a*.) Hair of thorax whitish, not distinctly fulvous. Belgian Congo: Dilolo, July 25 (J. O.). (2*b*.) Hair of thorax above light bright fulvous. Three from Zambi, Belgian Congo, June 22, 1915 (L. and C.).

FEMALE.—Belgian Congo: Dilolo, July 23 (J. O.).

Anthophora fallax Smith

Cape Province: Van Rhyn's Pass, Nov. 21 (J. O.).

Anthophora torrida Smith

Belgian Congo: Malela, July 9, 1915 (L. and C.); Stanleyville, April 19, 1915 (L. and C.).

Anthophora spilostoma Cameron

Cape Province: Graaff-Reinet, Oct. 25 (J. O.). This is identical with a species from near Johannesburg, in the British Museum, standing as *A. spilostoma*. It does not exactly agree with Cameron's description, thus the tegulæ are light fulvotestaceous, and Cameron says piceous. I cannot at present explain the discrepancy.

AMERICAN MUSEUM NOVITATES

Number 548 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | July 8, 1932

59.9, 32 T (87)

A NEW SPECIES OF *THOMASOMYS* FROM VENEZUELA

BY H. E. ANTHONY

A single specimen of *Thomasomys*, collected on a recent short expedition to northern Venezuela, proves to represent an undescribed species of this interesting genus.

I take pleasure in naming this new species in honor of Mr. Gilbert Ottley, who has supported the work of the American Museum and been a volunteer assistant on several expeditions to South America and the West Indies.

Thomasomys ottleyi, new species

TYPE.—No. 96,169, Amer. Mus. Nat. Hist.; ♂ ad.; Paramo de los Conejos, about fifteen miles north of Merida, Venezuela; altitude 9600 feet; February 7, 1932; collector, H. E. Anthony. The type is a skin and skull in good condition.

GENERAL CHARACTERS.—Quite similar in superficial appearance to *Thomasomys rhoadsi*, being one of the dark-colored, short-tailed[1] members of the genus, but differing from it in skull characters. Distinguished from *T. laniger emeritus* and *T. vestitus*, both of which occur in the Merida section, by size and color differences in the skins and by marked cranial characters. Zygomatic plate with oblique, straight anterior margin; postpalatal pits present, though very small, and suggestive of *Oryzomys*.

DESCRIPTION.—Color above, almost uniform fuscous black (Ridgway), speckled with snuff-brown, darkest on the rump. Individual hairs of back sooty black for almost their entire length with tips either snuff-brown, sooty black, or banded brown and black, with a sprinkling of long, all black hairs. Head and sides of body with less sooty black; hands and feet above, clove-brown; tail, above and below, clove-brown. Underparts olive-brown with sooty bases of hairs showing through.

Skull long and slender with rounded, tubular rostrum and interorbital region; lacrymal region without noticeable pit or excavation characteristic of most other species of the genus; zygomatic arches showing very little expansion, scarcely extending laterally beyond plane of brain-case; anterior margin of zygomatic plate straight and oblique; palatal foramina rather short; postpalatal notch reaching to plane of last molars; bullæ moderately inflated.

MEASUREMENTS.—Taken in the flesh: total length, 232 millimeters; length of head and body, 111; tail vertebræ, 121; hind foot (c.u.), 30. Skull, greatest length, 30; condylo-incisive length, 27.1; length of nasals, 11.6; interorbital breadth, 5.9; zygomatic breadth, 14.2; breadth of brain-case, 13.5; incisive foramina, 5.4×2.4; length of upper molar series, 4.5.

[1]Not short-tailed in actual length but in comparison to the distinctly longer-tailed members of the genus.

Only one specimen of *Thomasomys ottleyi* was taken, in a damp, mossy spot in humid, temperate forest, and it was a surprise to discover a new *Thomasomys* in a region where two distinct forms are known to occur. The members of the sooty-colored section of the genus are often in the same localities frequented by the brown forms, but so far as I am aware, none of these short-tailed, dark representatives have been taken as far to the eastward before. Throughout the main ranges of the Andes of northern Peru, Ecuador, and Colombia the short-tailed dark *Thomasomys* are a well-established group and it is, perhaps, to be expected that it would occur in the Merida Andes.

To represent *Thomasomys laniger emeritus* of Thomas, described from Montes de Escaguer, Venezuela, I have a series of seven specimens collected in the Merida district by Osgood and Conover and kindly loaned to me by Dr. W. H. Osgood of the Field Museum. *Emeritus* is a small, distinctly brown, long-tailed form and not to be confused with the robust, blackish *ottleyi*.

I have no representative of *T. vestitus* which Thomas described from a specimen taken on the Rio Milla of Venezuela, which species would appear to belong with the dark-colored members of the genus. *Vestitus* is larger (hind foot 33.3 against 30 for *ottleyi*) than *ottleyi*, apparently browner in color, to judge from the type description, the anterior edge of the zygomatic root is vertical instead of oblique, and the skull measures consistently larger throughout (upper molar series 6.2 compared with 4.5, diastema 10.2 against 7.2) except for the interorbital breadth which is 4.9 as against 5.9 for *ottleyi*.

The presence of tiny postpalatal foramina is rather unusual in the genus *Thomasomys* and the absence of these has been used as one of the characters to distinguish *Thomasomys* from the closely allied *Oryzomys*. A cursory examination of part of the rather large series of skulls of *Thomasomys*, which this museum now possesses, has disclosed the fact that occasional individuals have a foramen on one side or a minute vestige of paired openings, as the case may be. No effort has been made to tabulate the frequency of this occurrence or to discover whether some forms show it more often than others. I suspect, therefore, that the presence of postpalatal foramina in *Thomasomys ottleyi* is a character of questionable value and one that may not hold up if a larger series is obtained.

AMERICAN MUSEUM NOVITATES

Number 549 | Published by The American Museum of Natural History, New York City | August 11, 1932

59.81 (729.6)

THE REPTILES OF GREAT INAGUA ISLAND, BRITISH WEST INDIES

By G. K. Noble and G. C. Klingel

While on a cruise through the West Indies in the interests of the American Museum and of the Natural History Society of Maryland, the yawl 'Basilisk' was wrecked on Great Inagua Island in the southern Bahamas. Mr. G. C. Klingel remained there from December 10, 1930 to March 11, 1931, and devoted considerable time to collecting and studying the reptiles of the island. Mr. W. W. Coleman, the other member of the expedition, helped greatly with the work but was obliged to return home on January 13, 1931. A brief account of the work, together with some illustration of the lizards and a few of the habitats, has already been published (Klingel, 1932). Although 1734 specimens of reptiles were collected, these include only six species and one subspecies. We believe this small number is a complete representation of all the species of reptiles to be found on the island, exclusive of the sea turtles. No Amphibia were secured in spite of diligent search during both the day and the evening, as well as after rains.

Great Inagua is about forty-five miles in greatest length and eighteen in width. Its reptilian fauna is poorer in species than that of many Bahaman islands of much smaller size, such as New Providence, for example. In attempting to account for the poverty of reptile life on Great Inagua we have examined both the ecological conditions on the island and the relationships of the species found there. Two species and one race are reported below as new. One of these species is so markedly different from *Aristelliger*, to which apparently it is most closely allied, that it is referred to a new genus. The degree of endemism on Great Inagua is exceedingly high.

Topography and Vegetation

Great Inagua is the second largest of the Bahama Islands and the most southern of the series. It is very irregular in outline, but extends in a general east-and-west direction. It is a very flat and low-lying island. The highest elevation according to the West Indies Pilot is East Hill, near South East Point, which rises to one hundred and thirty-

two feet. There are a few hills on the east and south sides of the island and several on the north side, but these are rarely over fifty or sixty feet in height.

From the sea, Great Inagua appears heavily wooded, especially along its north and west shores. On closer inspection the trees and shrubbery are found to be of xerophytic types. The vegetation is largely confined to the coastal stretches of the island but North East Point is wooded across its whole width. Some of the woods, especially those on the north and west sides of the island, are practically impenetrable. Most of the east and south sides of the island are very barren. The plant life is stunted, and the bushes are often not higher than the knee. Sea grapes which reach a height of six or eight feet on the north and west sides of the island usually do not exceed one and one-half feet in height in these areas.

The central part of Great Inagua is occupied by a large lake roughly rectangular in shape and measuring approximately ten by twenty miles. The body of water appears to have no name and is called merely "the lake" by the natives. Apparently no accurate survey of the limits of the lake has been made. It is extremely shallow, averaging only three to four feet in depth. The bottom is largely bare rock with here and there a thin layer of silt. The water is bitter salt and very muddy in appearance. The surface of the lake is dotted with hundreds of islands of varying extent, some very low and others attaining a height of forty feet. Five of the islands on the western edge of the lake were visited but found to be devoid of life. The natives reported lizards present on some of the islands but no attempt was made to check this claim.

The land from the shores of the central lake to within a few miles of the coast forms a great inland plain or savanna (see Klingel, 1932, figure on p. 54). The savanna supports very little vegetation other than a few thin lines of thatch-palm and some buttonwood trees. A few birds and many large land-crabs occur in this area. During the rains large portions of the savanna become covered with water and are impassable. At such times the central lake must increase greatly in diameter. This drowning process may well account for the scarcity of reptile life throughout the central part of the island, but there is still another feature to be considered.

Origin of the Reptilian Fauna

The herpetological fauna of Great Inagua Island is characterized by its high degree of endemism and the small number of species found in this

comparatively large island. Mona Island, only six and one-half miles long by four miles wide, is reported by Schmidt (1926) to support eight species of reptiles and one amphibian. Beata, a small islet of about the same size lying to the southwest of Santo Domingo, agrees with Mona and Great Inagua in its xerophytic vegetation but is now known to include seven species of reptiles within its small confines (Cochran, 1931). On Inagua, regardless of the encroachments of the central lake, there is much more available land than in either of these two small islets, and hence a larger reptile fauna would be expected. The failure of Great Inagua to attain the expected richness of reptile life apparently is due more to the geological history of the island than to the ecological conditions existing there today.

A large part of the island has only recently emerged from the sea. There is much evidence of recent uplift on the island. Perhaps the most conspicuous example is five miles east of Polacca Point. A mile-long section of beach is now two hundred feet back of the shore-line and fourteen feet above the surface of the sea. Near Salt Pond Hill on the south coast is another well defined beach some distance from the present shore.

A comparison may be drawn between Great Inagua Island and the nearby Caicos group. The lowlands of Inagua, like the Caicos bank, face the southwest. There are no hills on the western end of Inagua, and no islands project above the surface of the water on the western end of the Caicos bank. At the present time the Caicos bank appears to be shoaling. We assume that Inagua arose above the sea in much the same way in very recent geological time. The West Indies Pilot (I, p. 184) states:

> There is no doubt that Caicos Bank will, in the course of time, become one island. All evidence points to its constant shoaling. Historical accounts of the pursuits of piratical craft across the bank by naval vessels in the eighteenth and early part of the nineteenth century indicate that even 100 years ago deep channels existed where today a vessel drawing but six feet of water has to proceed with caution. . . .

There are natives on Inagua who recall anchorages once deep which are now shallow. This in itself cannot be considered evidence of uplift. The raised beaches and the general similarity between Inagua and the Caicos Bank, however, are very suggestive of such changes.

Although it is generally agreed that the Bahamas have suffered submergence in Recent geological time, there is evidence that in other parts of the Bahamas this submergence was followed by local movements of emergence. Such recent uplifts have been reported by Vaughan

(1919) in other islands. Although the flooding of the central plain of Great Inagua by rain-water must tend to restrict the ranges of the species, it seems to us that the poverty of species is to be explained primarily by the fact that Great Inagua in Recent geological time was a series of small islands which were incapable of supporting a large reptile fauna. These mother islands which gave rise to Inagua presumably have been isolated from other Bahaman or Great Antillean islands for a considerable period of time, because five of the seven forms of reptiles found on the island are restricted to it. Further, one genus is found only on Great Inagua and Navassa, lying to the southwest. In the following review of the species of reptiles found on Great Inagua we shall emphasize the degree of difference between the species and their nearest relatives, because where a marked difference exists it is usually assumed that a considerable period of time must have elapsed to have produced this divergence.

ARISTELLIGELLA new genus

Closely allied to *Aristelliger* from which it differs chiefly in the increased number of friction pads asymmetrically arranged on one or the other side of the claws. Digits without webs, four outer ones dilated at the extremity and provided with a series of undivided transverse lamellæ below; third and fourth digit of each fore limb and three outer digits of each hind limb with the distal joint long, compressed, clawed, and arising from within the extremity of the digital expansion; first (inner), second and fifth digit of the fore limb, first and second digit of each hind limb short, the claw, except at its tip, concealed by enlarged scales; the inner digit of both fore and hind limb with two enlarged friction disks formed by single scales on either side of the claw, the postaxial one-third larger than the preaxial disk; second digit of both limbs with a similar disk on the postaxial side of the claw; fifth (outer) digit of the fore limb with a similar enlarged scale on the preaxial side of the claw (Figs. 1 and 2). Upper surfaces with granular scales, belly with cycloid scales which tend to imbricate. Pupil vertical, a rudiment of an eyelid above the eye. No femoral, nor preanal pores; hemipenis bifurcate with a calcified tooth-like structure with serrated edges crowning each summit and flanked by a cluster of similar structures of much smaller size.

HABITAT.—Known only from Great Inagua and Navassa Islands, B. W. I.

Aristelligella barbouri,[1] new species

TYPE.—A. M. N. H. No. 45829; adult female; South West Point, Great Inagua Island, B. W. I.; February 1931; G. C. Klingel.

DESCRIPTION OF TYPE.—Snout, one and three-fourths the diameter of the eye; distance between eye and ear opening equal to the distance between eye and nostril; ear opening small, oval and oblique, its greatest diameter a little more than one-third the diameter of the eye. Head and upper surfaces of the body covered with fine granules or at least smooth rounded scales, the scales on the occiput about one-half as

[1]Named in honor of the leading student of West Indian herpetology, Dr. Thomas Barbour of the Museum of Comparative Zoölogy.

large as those between the eyes, scales covering the snout nearly twice as large as those between the eyes, approximately the same size as the scales on the sides of the body; approximately thirty-one scales from the sides of the body contained in distance between tip of snout and middle of eye; a small upright scale over the middle of the eye, smaller than the superciliary scales anterior to it; rostral twice as broad as long with a median cleft above; nostril bordered by the rostral in front by a very narrow scale below and behind and by two supranasals above; ten supralabials, the two posterior ones much smaller than the others, eight infralabials, mental nearly twice as broad as long, sharply pointed behind, the posterior margin bordered by a pair of scales, each scale one-half as large as the first infralabial. Abdominal scales, two to three times as large as dorsals, smooth, cycloid and more or less imbricated. Eight lamellæ under the fourth toe. Tail cylindrical, except near tip where it is slightly compressed; nearly as long as the head and body; tail covered with small, flat, slightly imbricated scales above, with much larger cycloid scales below (regenerated scales short and very wide).

Pale brown above; a broad streak of dark brown on either side of the head merging with a pair of large brown blotches on either side of the neck; this head-stripe margined above with white; the posterior pair of neck-blotches confluent in the midline of the back. A series of six irregular transverse streaks on body, the anterior half of each dark brown, the posterior half white. Tail encircled above with nine broad bands of dark brown, these tending to fuse near the ventral surface of the tail. Ventral surface of head and body white; base of tail pale but remainder ringed with dark brown.

DIMENSIONS

Total length	89	mm.
Snouth to vent	45	mm.
Tip of snout to ear opening	10.5	mm.
Width of head	8	mm.

VARIATION.—The newly hatched young is dark brown with a series of eight saddle-shaped areas of pale gray feebly edged with white extending from occiput to tail (Fig. 3). The ground tone of the tail is a very dark brown and the series of dorsal saddles is continued on the tail as a series of white rings. *Aristelligella* agrees with *Aristelliger* (or at least with *A. lar*) in that the young have much more white on the tail than the adults. With age the pale saddles tend to disappear, while the narrow area between the saddles is retained as a series of dark cross-bands edged posteriorly with white. In adult life there is considerable variation in the intensity of the ground tone, which may vary from gray to brown. The dark cross-bands may become irregular and may be represented merely by transverse spots or streaks of brown or white. The sides of the body also may become flecked or streaked with white. The specimen shown in figure 4 may be considered to have an average development of the color pattern.

RELATIONSHIPS.—Thanks to the kindness of Major Chapman Grant, we have had the opportunity of examining the series of *Aristelliger cochranæ* described by him in 1931. This species agrees with *Aristelligella* and differs from all known forms of *Aristelliger* in the digital characters described above. We therefore refer this species to *Aristelligella.*

A recently hatched individual of *A. cochranæ,* measuring 46 mm. in total length, agrees closely with the young of *A. barbouri,* but the saddles on the back more nearly approach a square. With increasing maturity *A. cochranæ* develops a pair of dark lateral stripes, as already reported by

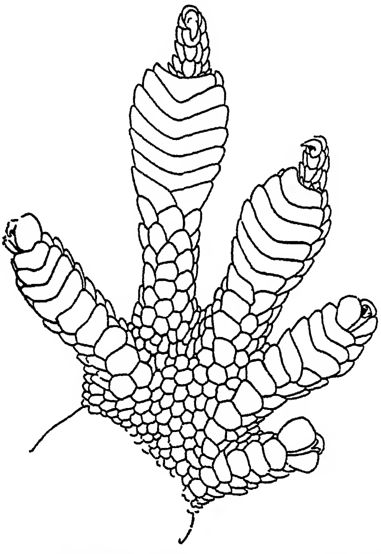


Fig. 1. *Aristelligella barbouri,* new genus and species.
Right fore foot viewed ventrally, ×10.

Major Grant. The adult *A. cochranæ* therefore differs radically from *A. barbouri* in having a pair of longitudinal stripes instead of narrow crossbars. The snout of *A. cochranæ* is narrower and more pointed than that of *A. barbouri.* There are approximately eighteen scales in the loreal region between the nostril and the rudimentary eyelid, while in *A. barbouri* there are fourteen scales in the same distance.

Since the herpetology of Navassa shows close relationships to that of Hispaniola, it might be assumed that *Aristelligella* will some day be discovered on Haiti. *A. barbouri* is sufficiently distinct from *A. cochranæ* for us to assume that there has been little interchange between the faunas of Navassa and Great Inagua for a considerable period of time.

HABITS.—Lizards of this species were found to be very secretive and were never seen abroad during either the day or the night. All of our series of fifty specimens were taken either in decayed wood or under the loose bark of sea-grape or cocoanut-palm. All were collected on South West Point, although a special search was made for them elsewhere on the island, and particularly on North West Point. The majority of the specimens were taken in a grove of dead cocoanut-palms a half mile from the Inagua Light Station.

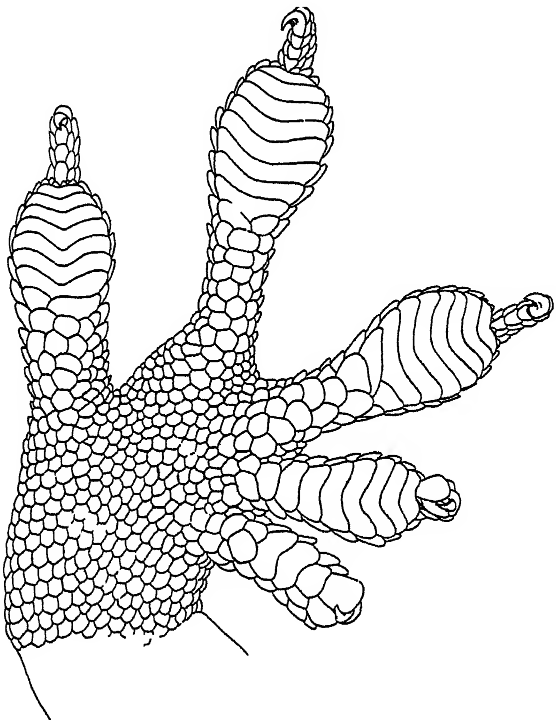


Fig. 2. *Aristelligella barbouri.*
Right hind foot viewed ventrally, ×10.

The discovery of the species came about through the finding of a number of broken egg-shells beside a decayed palm trunk. Search in other dead trees brought to light several clutches of eggs and finally the adults. The eggs with few exceptions were laid in small cavities in decayed wood a short distance under the loose bark. A few clutches were fastened to the bark itself. All the eggs were attached in a more or less

vertical position and were fastened tightly to the wood. There was usually only one egg in a single cavity but in many cases there were several. An exceptional find was a piece of bark approximately 170×100 mm. with twenty empty egg-shells and one good egg attached. It was not unusual to find one or more fertile eggs laid beside broken and apparently long-hatched ones. The eggs were usually attached three or four feet from the ground.

An examination of the oviducts and ovaries of fourteen gravid females showed conclusively that only one egg is laid at a time. In nine of these fourteen females the egg was found in the oviduct, and in four of these cases a calcareous egg-shell had already been deposited. In the five cases where an egg was greatly enlarged but still in the ovary, the remaining ovarian eggs were usually very small. However, in two cases where a calcareous shell had been deposited on the egg in the oviduct, an ovarian egg was found to have enlarged; in one instance to one-half

Fig. 3. *Aristelligella barbouri.*
Eggs and recently hatched young Enlarged about one-fourth.

the diameter of the egg in the oviduct, and in another case to one-third the diameter. We have no data in regard to the frequency at which eggs are laid. Since in our series the females carry only one egg in the oviducts at one time, and since in no case is a second egg ready to be laid, it seems certain that only one egg is laid at one time and that a considerable period must elapse between each egg-laying.

If this be the correct conclusion, the three eggs comprising the group found together and photographed without disturbing them, in all probability, were laid by three different females. It is possible that the

same female laid all three eggs, returning at different times to the same egg-laying site. In either case, the sight of the previously laid eggs appears to stimulate the gravid female, because the eggs are laid in contact even when there is considerable space within the breeding cavity (Fig. 5). While single eggs may be deposited in suitable cavities, our series of eggs reveals a distinct tendency for *Aristelligella* to lay its eggs in contact with those previously laid. From the data at hand it cannot be decided whether the large number of eggs found together in one case

Fig. 4. *Aristelligella barbouri.*
Living adult with average color pattern Enlarged about two-fifths

represents a return of a single female over a long period of time to one breeding site, or whether several females were attracted to one favorable spot.

As shown in the photograph (Fig. 5) the eggs of *Aristelligella* are oval and frequently taper more sharply at one end than the other. Four eggs containing living embryos measured as follows: 11.5×8, 12×7.5, 12×8, 12×8.5 mm. in diameter. Two additional eggs preserved in formalin measure 12×8 and 12×7.5. The shell is calcareous, brittle, and as usual in lizards, it is colorless. The living egg is pinkish, apparently due to the underlying vascular membranes.

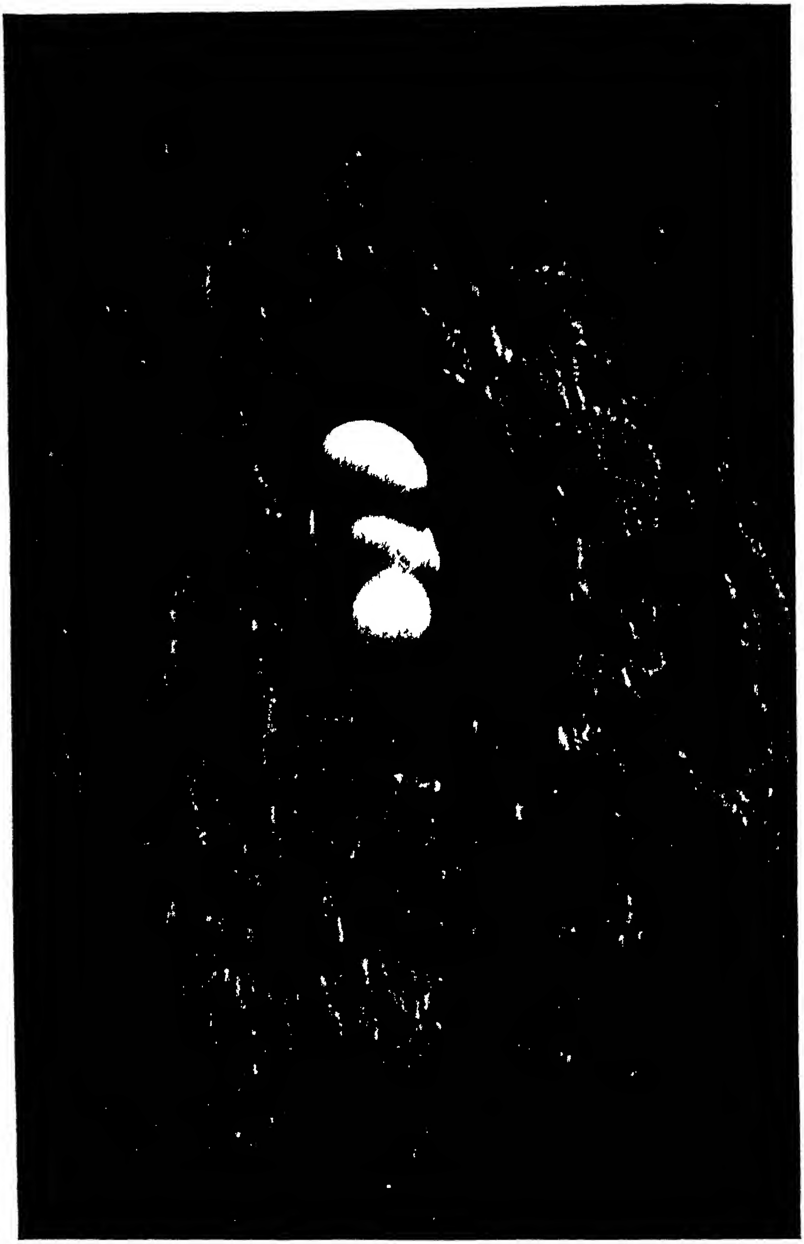


Fig. 5. Eggs of *Aristelligella barbouri* photographed *in situ.*

A female lays only one egg at a time. These apparently were laid by three females in the same hollow. Enlarged about one-third.

The single egg of *Aristelligella* may escape by either the right or the left oviduct. Seven of our nine females containing eggs in the oviducts had an egg in the right oviduct, and only two held the egg in the left. Of the five containing enlarged ovarian eggs, three had hypertrophied, one egg in the right and two in the left ovary. It may be concluded from these data that the right ovary and oviduct functions more frequently than the left.

The first eggs were collected on January 7, the last on February 14, 1931. A female containing an egg in her oviduct nearly ready to lay was preserved April 6. An egg preserved January 20 contained an embryo nearly ready to hatch. Another egg collected February 14 hatched in the laboratory 75 days later. Obviously it had been subjected to temperatures much lower than those of its natural habitat and consequently may have been developing more slowly than it would have if left undisturbed. From these data it is impossible to decide the period of incubation in the species.

In hatching, the young lizards do not cut out of one end of the shell a neat lid as in the case of *Sphærodactylus* when left undisturbed. At least, the one lizard which hatched in the laboratory partly cracked and partly tore its way out. The empty egg-shell remained intact except for the ragged opening through which the young lizard escaped. *Aristelligella* has two forwardly directed "egg-teeth" on the premaxillaries. It is possible that if this egg had been left undisturbed, the hatching lizard would have cut a more regular outlet.

The recently hatched young is dusky brown above with lighter markings. There are seven pale saddles on the back and eight rings on the tail. The proximal saddles are incomplete below and are darker than the distal ones. A dark brown stripe extends along each side of the head and through the eye. The upper surface of the head is paler than the ground tone of the back. The ventral surfaces are pale and translucent without darker markings. The recently hatched lizard measures 38 mm. in total length, 18 mm. in head and body length.

Sphærodactylus inaguæ, new species

Diagnosis.—A small species, adults approximately 50 mm. in total length; scales on snout, except first two or three rows, are feebly keeled, two to three times as large as those on the occiput; scales on the upper surface of the body imbricate and keeled, no mid-dorsal zone of smaller scales; eight scales in a row along the side of the body contained in distance between tip of snout and center of eye; belly scales smooth and rounded, much broader than the dorsals; chest-scales smooth. Sexual dichromatism usually but not always well marked in adults; ground tone a pale brown; males with a series of large dark brown spots on the head, the body with a few small and in-

distinct spots; females with three longitudinal stripes of dark brown on the head and a large dark spot on the scapular region, more or less surrounded by a narrow dark line to form a "target" roughly rectangular in shape; body of female with a few small dark blotches or indistinct cross-bands; tail more heavily spotted but no sacral figure.

DISTRIBUTION.—Great Inagua Island, B. W. I.

TYPE.—A. M. N. H. No. 45746; adult male; Mathew Town, Great Inagua Island, B. W. I.; Gilbert C. Klingel.

DESCRIPTION OF TYPE.—Snout nearly twice as long as the eye (exclusive of marginal fold); distance from tip of snout to center of eye a trifle more than distance from center of eye to ear opening; rostral plate rounded without a lateral ridge or canthus, rostral with a long median cleft behind but without smaller lateral ones; nostril surrounded by the rostral, first labial, the enlarged supranasal and two small scales; a single scale between the supranasals and this scale slightly larger than the small scales covering the upper surface of the snout; three enlarged supralabials; a spine-like scale on the superciliary margin over the center of the eye; scales between the eyes and covering the upper surface of the head posterior to this point small and strongly keeled, only one-half to one-third the diameter of the scales covering the upper surface of the snout; those scales covering the snout are swollen, two or three rows immediately behind the internasals smooth, the remainder feebly keeled; seven scales in a row from the internasals to a line drawn between the corners of the eyes; eighteen scales in a row across the snout from supralabial to supralabial immediately anterior to the orbits; scales covering the upper surfaces of the body strongly keeled and imbricate, eight of those on the side of the body between the two pairs of legs contained in the distance between tip of snout and center of the eye. Longitudinal axis of mental a third longer than same axis of the rostral; three enlarged infralabials, the first twice as long as the second, the second a little less than twice as long as the third; two scales of irregular shape immediately posterior to the mental and only a trifle larger than scales following it; scales of the throat grading off in size posteriorly, those under each angle of the jaw and along each side of the neck are the smallest; those in the center of the throat at a level with the angle of the jaws are slightly smaller than those immediately anterior to them; throat scales posterior to the angle of the jaws increase rapidly in size; scales on chest and abdomen smooth and imbricate, scales on abdomen larger than those on chest and tending to be hexagonal, abdominal scales as long as dorsals and one-fourth broader; a broad band of scales on the pre-axial side of forelimbs covered with imbricated scales nearly as large as those on the chest; scales of this series on the upper arm keeled, those on lower arm smooth; the other scales on the forelimbs small and tubercular; scales on the preaxial side of the upper segment of the hind limb similar to the dorsals but smaller, merging gradually into those of the upper surface of the lower leg, which are much smaller and tubercular; scales on the ventral side of the hind limbs like those on the abdomen but diminishing in size distally; scales on the dorsal surface of the tail similar to the dorsal body scales but smaller, ventral tail scales hexagonal and a third broader than long (except the regenerated scales which are much broader).

Ground tone a pale grayish brown. Three longitudinal stripes of dark brown on the snout, the one in the mid-line broader than the lateral ones which cross the loreal region, all three with very irregular margins, upper surfaces of the head posterior to the snout covered with a series of large spots of dark brown, each one-third to one-

half the diameter of the eye; the spots arranged in seven longitudinal rows, but some smaller spots occur ventral to these along the lips and behind the mouth; head spots continuous with a series of smaller spots on the neck, these diminishing rapidly in size until they become the size of one or two scales in the scapular regions; the series continued on the dorsal surface of the body as a series of very indistinct dark spots, most of these covering only part of a scale and many tending to form poorly defined ocelli; the spots increase in size on the tail where they may cover parts of three or four scales; ventral surfaces white, feebly stippled with dark brown along the sides, and spotted with the same tone on each side of the neck and on the under side of the tail.

DIMENSIONS

Total length	50 mm.
Tip of snout to vent	26.5 mm.
Width of head	4.5 mm.
Fore limb from axilla	4.5 mm.
Hind limb from groin	9.5 mm.

VARIATION AND SEXUAL DIFFERENCES.—After an extensive study of the sphærodactyls of Porto Rico and adjacent islands, Grant (1931) has clearly stated the characters which he finds most useful in defining the species of this area. We are indebted to Major Grant for his discovery of a reliable secondary sexual character of value in distinguishing sexes. He states (1931, p. 199): "The male of all species has an escutcheon about five to seven scales long by ten wide, of very smooth, unkeeled scales on the lower belly, not reaching the vent by five or six rows. It extends onto the thighs. It is obvious in even the smooth-bellied species and makes sex determination easy." As shown in Grant's figure (plate xx) this area is often white or poorly pigmented and stands out conspicuously if the belly is colored.

Under the higher binocular powers the scales forming this escutcheon are found to be not smooth, but minutely pitted. Each scale is greatly thickened and its caudal margin does not lie flat like the belly scales but is raised slightly. When the scale is removed and compared with a belly scale the greater thickness of the margin of the escutcheon scale is readily observed. The escutcheon therefore taken as a whole, or as a part, does not present a smooth surface but a decidedly rough front when compared with the broad shingle-like belly scales of *inaguæ*.

The escutcheon from its position may well be compared with the preanal organs of many gekkonids and other lizards. Moreover, it is often continuous with a similar series of scales along the ventral surface of the thighs. In *Sphærodactylus cinereus*, for example, the median shield, or escutcheon proper, is small and a narrow band of thickened scales extends down the ventral surface of the thigh for its entire length.

This band is only three scales wide at the proximal end of the thigh and two scales wide at the distal end. The band is so narrow that it bears an obvious resemblance to a row of femoral organs. In *S. lineolatus* the band of hypertrophied scales on the thighs closely resembles that of *S. cinereus.* In *S. difficilis,* however, the thigh bands have widened and are four scales broad at the proximal ends of the thighs. In *S. goniorhynchus* they are also broad. In *S. molei,* on the other hand, there are no thigh bands. In the adult male a conspicuous shield of swollen scales is found five scales anterior to the vent. The shield is oval in form and does not send two lateral extensions down the thighs. Hence, while the area of hypertrophied scales of *S. inaguæ* and *S. cinereus* can be compared with a confluent series of femoral and preanal organs, that of *S. molei* bears a resemblance to preanal organs alone.

A microscopic examination of the integument from the ventral surface of a male *S. inaguæ* has shown that these hypertrophied scales have a certain structural resemblance to the femoral and preanal organs of other lizards. The epidermis and not the underlying corium of these scales is hypertrophied. While the epidermis covering the scales from the anterior or extreme posterior part of the abdomen averages only three cells in depth, the epidermis of the hypertrophied scales may be formed of eight or more cell layers. In the unmodified scales the two outer layers of cells are flattened, while in the hypertrophied scales all the cells except those in the most superficial layer are enlarged and show no tendency towards a flattening. In fact, many are elongated vertical to the surface of the scale. Where the scale is slightly torn the cells tend to form vertical columns and never the sheets of cells found in unmodified scales. The most superficial layer of the hypertrophied scales is cornified, but since it tends to follow the contour of the underlying cells this layer is very irregular and does not present the smooth surface which characterizes the surface of unmodified scales. In the reduction of the number of flattened cell-layers the hypertrophied scales of *Sphærodactylus* approach femoral organs in structure and differ from the hypertrophied tarsal scale which characterizes the male of certain skinks (Gandolfi, 1908).

Another striking difference between the unmodified and hypertrophied scales was already noted in the external examination. While the normal scales overlap for about one-half their length the hypertrophied scales show very little overlap. The result is that the hypertrophied scales are able to present a firm front to an object rubbed caudo-cephally against them. In this they agree with the femoral organs of male lizard

during the height of the breeding season. They differ from preanal and femoral organs in that the whole scale and not merely a localized portion of each scale is hypertrophied. Since the entire epidermis of each scale is hypertrophied there is no buckling in, or follicle-like ingrowth, of the epidermis such as occurs in the femoral organ. In view of the absence of such ingrowths it might be assumed that *Sphærodactylus* possesses the most primitive type of femoral and preanal organs. Hypertrophied scales may have been the fore-runners of preanal and femoral organs of other lizards but *Sphærodactylus*, itself, is one of the more specialized gekkonids (Noble, 1921) and did not give rise to other less specialized genera possessing the typical femoral and preanal structures.

The hypertrophied scales of the male *Sphærodactylus* doubtlessly fluctuate with the season, for we find considerable variation in the degree of thickening in the large series of specimens preserved in the American Museum. In this seasonal change they further agree with the femoral organs of other lizards.

As a matter of practise we find the hypertrophy of these scales less diagnostic of sex than another male character which we believe has not been hitherto described. The posterior lip of the cloaca is very much broader in the adult male than in the adult female. Most females preserved by ordinary methods in the field have the cloaca closed and exhibit little or no fleshy margin to the caudal side of the cloaca. Most males preserved under similar conditions have this fleshy margin broader and exhibit a tendency for it to fold back towards the tail. The central portion of this lip is usually broader than the lateral portions and hence the lip has a sinuous edge. The only adult males in our series which do not show this distinctive lip are not well preserved or are so bent that the cloacal lips do not meet in the normal way. In checking through the series of sphærodactyls in the American Museum we find the lip less variable than the hypertrophied scales. It is, therefore, probable that it undergoes little seasonal change.

Grant (1931) lays considerable emphasis on sexual dichromatism as a diagnostic species character in his sphaerodactyls from Porto Rico and adjacent areas. Since only *macrolepis* of the species he describes is available to us in series we have made no attempt to confirm his findings. In *inaguæ*, however, we have been able to establish definitely that there is considerable variation in color, and the sexes of adults cannot always be distinguished by a difference in coloration. Fully adult males, as recognized by well-developed femoral and preanal scale hypertrophies, may have a spotted, striped, or rarely a plain head. Adult females containing

well-developed eggs usually have a striped head but the color pattern may be very weakly developed. For example, A. M. N. H. No. 45769 is a breeding male and nevertheless has three longitudinal head stripes and a faint "target" in the scapular region. Again, No. 45783 is an adult female and No. 45774 an adult male and yet both are faintly spotted or blotched over their entire dorsal surface. Since immature specimens have essentially the pattern of the female, it would appear that a small percentage of the males may reach sexual maturity before they have lost the "target" and acquired the head-spotting characteristic of the male. On the other hand, since only a few adult females have a faded pattern, most females are readily recognized by their striped head. In view of the wide limits of variation in *inaguæ*, it seems probable that other species of *Sphærodactylus* are more variable than Grant and others have assumed.

RELATIONSHIPS.—*Inaguæ* is one of the smaller species of *Sphærodactylus*. Like *corticolus* and *difficilis*, adults of *inaguæ* usually exhibit a well-marked sexual dimorphism, the males having round spots on the upper surface of the head, the females elongate spots or streaks. *Inaguæ* differs from *corticolus* in its larger dorsal scales, from *difficilis* in its smaller size and different color pattern. From *monensis* it differs in its smooth chest, "escutcheon" extending down the thighs of the male, and a marked sexual difference in color usually present. From *nicholsi* it may be distinguished by its large size, smaller dorsal scales and the absence of a V-pattern on root of tail. In brief, although *inaguæ* may be closely related to either *corticolus* or *difficilis*, it exhibits several characters which distinguish it from these species and from all other species of *Sphærodactylus* described from nearby islands.

HABITS.—*S. inaguæ* is one of the most abundant species of lizards of Great Inagua. It was found widely distributed throughout all the coastal areas, but was much more common in the north and west than in the south and east. It apparently shows a preference for heavily wooded areas, but was also found in and about houses. Specimens were collected from beneath loose boards and shingles and flat stones. The eggs of *S. inaguæ* were found for the first time on January 20, 1931, on the under side of a tamarind shell. Others were later found in many localities: under flat stones, boards and in hollow sisal stems, under shingles, in roof thatch, and in cocoanut fiber. A photograph of some eggs in the latter situation has already been published (Klingel, 1932, p. 49). Most of the eggs were found in the vicinity of Mathew Town and South West Point. The eggs are laid singly and measure 7×5 mm. when containing well-developed embryos. Only a single egg reaches maturity at one time.

In ten females, taken at random, eight contained a single egg in the right oviduct and two contained an egg in the left. A series of eggs collected February 16, 1931, and maintained at a temperature of 28° C. since February 25, hatched on March 4. Only two other eggs of those collected hatched. One was taken January 27 and the other February 16. Both of these hatched on April 14. Hence the period of incubation lasted at least fifty-seven to seventy-seven days in these two cases. Since no captive *S. inaguæ* laid eggs, the period of incubation is not exactly known.

Recently hatched young are smaller than those of *S. difficilis.* They measure 14 mm. in total length and have a black scapular shield followed by two white spots. There is no white tail-tip as in the young *difficilis.* The iris of both young and old is a pale blue, very different from the dark iris of *difficilis* and other species of *Sphærodactylus* which we have seen alive.

S. inaguæ is essentially a nocturnal lizard, although many come from their retreats at approximately six in the evening. After dark, many are seen running over the floors and walls of the native huts. The local name for *S. inaguæ* is "bubatani," or "snail lizard."

Anolis leucophæus Garman

Anolis leucophæus Garman, 1888, Bull. Essex Inst., XX, p. 109. Barbour, 1930, Bull. Mus. Comp. Zool., LXX, p. 129.

The only species of *Anolis* on Inagua varies considerably in color. Specimens fixed in formalin and preserved in alcohol have a ground tone which varies from yellowish white to chocolate-brown. The whole dorsal surface is speckled with small spots of dark brown. In some specimens a series of transverse bars of dark brown extend across the midline of the back. These may be limited to the shoulder region or may form a series extending from fore to hind limb. The speckling of dark brown is also subject to much variation. In a series of specimens from Sheep Cay, near North West Point, the spots may reach a size larger than the ear opening. However, intermediates between this condition and the fine speckling characteristic of most specimens are to be seen in our large series of several hundred specimens from Great Inagua. Further, we can find no structural character to separate these Sheep Cay specimens from the remainder of the series.

In life, *A. leucophæus* exhibits even a greater range of color variation. In the bright light adults are usually a yellowish or grayish white finely speckled with dark gray. In the shade the same specimens may change to a rich brown ground tone above, which makes the dark spotting

inconspicuous. The lips in both pale and dark specimens are often a bright yellow although they vary from this color to white. The throat is often yellow and there may be a suffusion of yellow over the head or, less frequently, on the back. Color change is relatively rapid. Within five minutes a specimen with rich brown tone above and a spotting of a darker brown may fade out to a clay-gray with only the barest indication of the dark spots.

Relationships.—In view of the large number of species of *Anolis* found throughout the Greater Antilles and the Bahamas it is difficult to determine the nearest relatives of *leucophæus*. *Anolis* occurs on many islands, especially in the Lesser Antilles, which apparently were never part of a larger land-mass. It is doubtful, therefore, if the reported occurrence of *leucophæus* on Turks and the Caicos Islands may be considered evidence that these islands were formerly connected with Great Inagua. However, the herpetological fauna of the Caicos Islands is not well known.

Leiocephalus inaguæ Cochran

Leiocephalus inaguæ Cochran, 1931, Journ. Wash. Acad. Sci., XXI, p. 39.

Cochran (1931) has briefly described the distinguishing characters of this species which for a long time has been confused with *L. schreibersii*. We have had both species before us alive as well as a series of several hundred preserved specimens and find no tendency toward intergradation. There is only one species of *Leiocephalus* on Inagua and, like many other species of the genus, it exhibits marked sexual differences in color and also a change of color with age. Klingel (1932) has published photographs of both sexes (male figures on pages 44 and 45, female figure on page 46). The immature female is pale grayish brown with a series of twelve or more transverse bars of dark brown down the back. Similar series along each side of the body tend to fuse to form a dark lateral stripe. These bars are continued on the sides of the abdomen as a series of narrow transverse stripes broadly flecked with greenish or white. The under surfaces are white except for these transverse bars on each side of the abdomen and a series of irregular streaks of dark brown on the throat. The streaks in the mid-line of the throat have a longitudinal direction while those on either side extend obliquely from this series. In the adult female the dorsal spots are usually faded and the transverse bars on the sides of the body remain distinct, usually not forming lateral stripes.

In the fully adult male the throat-streaks are black and the transverse bars on the abdomen are suffused with pink. A wash of the same

tone is also found on the under surface of the tail and thighs. Three conspicuous black spots appear on the sides of the body in the shoulder region and these are continued posteriorly along the sides as a series of smaller dark spots. The transverse bars down the back are indistinct and some green occurs in this region.

RELATIONSHIPS.—*Leiocephalus inaguæ* appears to be most closely related to *L. schreibersii*, with which it was previously confused. *L. schreibersii* is abundant in the Monte Cristi region on the north shore of Santo Domingo, only 120 miles from Great Inagua. According to Barbour's most recent list (1930) *L. carinatus* has a wide distribution in Cuba, Isle of Pines, Cayman Brac and Bahamas. *L. inaguæ* is a large heavy-scaled lizard like *L. carinatus* and it is surprising that both *L. inaguæ* and *L. schreibersii* have not been able to extend their ranges to adjacent islands.

HABITS.—*Leiocephalus inaguæ* is found over the entire coastal area of Great Inagua and extends farther inland than any other species. Specimens were collected on the very edge of the barren savannas but no very large individuals were taken in the more arid east and south sides of the island. The species ranges throughout the rocky and more fertile areas and the character of neither the soil nor the vegetation seems to influence its distribution.

Inaguæ was often seen basking in the direct sunlight on the top of rocks, logs, or other points of vantage. Individuals usually appeared between eight and ten in the morning. The more windy or cloudy the day, the later was the first appearance. A record was kept for eight days of the temperature and weather conditions and the time of the first appearance of individuals noted. Temperature appeared to exert less influence than wind. On the clearest and calmest day recorded, the first *inaguæ* were observed at 7:45 A.M. although at that time the thermometer registered 69° F.

Inaguæ, in spite of its comparatively small size, will attack and devour other lizards. Twice individuals were seen to drive full-grown *Ameiva maynardii* from the district under observation. On February 3, 1931, a large *A. maynardii* was shot and fell, twisting and squirming. Before the lizard could be picked up a *Leiocephalus* dashed forward and, seizing the lizard in its mouth, attempted to escape. Large *Leiocephalus* were found to devour *Ameiva* when caged with them in the field.

On the approach of evening the *Leiocephalus* confined in cages would invariably wiggle down out of sight under the gravel covering the floor.

No doubt in nature a large percentage of the *Leiocephalus* make no burrow but merely work their way under the sand or other loose material at night. However, many others were found in holes among rocks, under boards, in hollow decayed palms and even in empty conch shells. Hence the species will seek a wide variety of cover and may not burrow on the approach of night if adequate protection is available.

An experiment was made to determine the range of wandering practiced by the individual lizard. A large number of individuals were captured, were banded with stripes of adhesive tape numbered with black waterproof ink placed around the body just forward of the hind legs, and were released a week and a half later near a stone wall frequented by *Leiocephalus*. The wall afforded many protecting crevices and the exact point of release was carefully noted. The wall was visited for a week and the position of the tagged lizards noted. All lizards released near the wall exhibited a considerable reluctance to seek shelter in its crevices in the manner of the *Leiocephalus* frequenting the region. Of seventy-one tagged lizards released only two were seen the next day on the wall. Another was seen the day after the release on the opposite side of the wall from the place of release. A fourth was seen in a different section of the wall from the place released. When first observed it attempted to escape by dashing into a hole, but finding this too small, it made its way towards another hole. On the third day after the release only a single tagged lizard was seen near the wall although the usual number of untagged *Leiocephalus* were present in its vicinity. This one lizard was seen on the opposite side of the wall from the point of release. No tagged lizard was seen later in the vicinity of the wall. It may be concluded that although lizards released in a foreign territory may tarry a day or more if conditions are suitable, they do not become established there if the region is already inhabited by lizards of the same species.

An attempt was made to discover where the released lizards had gone. One tagged lizard was noted nearly a quarter of a mile away from the wall only two hours after being released. Another was seen two weeks after the release practically the same distance from the wall. Many of the localities from whence the tagged lizards had been taken were visited but none was found to have returned to the home territory. Apparently the lizards after being removed from the original territories scatter widely through the country, radiating from the point of release with great rapidity.

No eggs of *L. inaguæ* were secured in the field although many apparently suitable situations were investigated. On June 17, 1931, a large

female which died in the laboratory was found to contain four large ovarian eggs. Each of the eggs measured approximately 12×12 mm. On August 3 another female laid three eggs in the laboratory. Preserved in formalin they measured 24×11, 22×10, and 19×10 respectively. The eggs are infertile and have become slightly distorted by drying. From this single observation, it would appear that egg-laying of *Leiocephalus* occurs in the autumn.

Ameiva maynardii maynardii Garman

Ameiva maynardii Garman, 1888, Bull. Essex Inst , XX, p. 10.

A. maynardi Barbour and Noble, 1915, Bull. Mus. Comp. Zool., LIX, p. 347.

Relationships.—Barbour and Noble (1915) indicated that *maynardii* was closely related to *wetmorei* and *polops* with which it agrees in several structural characters and especially the oblique scales on the dorsal surface of the tail. On the other hand it is obvious that *wetmorei, polops* and *lineolata* form a closely allied group from which *maynardii* differs fundamentally in color. Whether or not *maynardii* ever evolved from this group, it is a very distinct form which presumably has been isolated from other *Ameiva* stocks for a long period of time.

Our large series of eighty-one specimens of *A. m maynardii* from the vicinity of Mathew Town shows considerable variation. The middle of the back is usually a rich blackish brown similar to the sides, but in many specimens the posterior part of this dorsal stripe has faded to a fawn brown or grayish brown. This is an individual and not an age difference, for the extreme fading is reached in both half-grown and adult specimens.

Habits.—In the vicinity of Mathew Town *A. maynardii* is extremely common, especially about the ruins of old houses or partially destroyed walls. This species is uniformly distributed along the north and west coasts of Great Inagua from Mathew Town to Union Creek. Union Creek is a small inlet which extends from the coast to the inland savannas. *A. maynardii* apparently does not occur from Union Creek to Polacca Point, since no specimen was found here although the species was especially sought for over this entire area. This region is extremely rocky with little or no top soil and this may explain the absence of the species throughout the region. *Maynardii*, like other species of the genus, digs numerous burrows in which it spends considerable time. Apparently it is this burrowing habit which restricts the species to areas having a sandy or loamy soil.

On the north coast *maynardii* reappear again in the vicinity of Polacca Point where a number of specimens were found immediately back of the shore-line. Approximately five miles east of Polacca Point the country becomes rocky again and many pitted and greatly eroded stones are found along the coast for about ten miles in a region known locally as the "Ocean Bight." No specimens of *maynardii* were found in this region nor in the sandy country east of it. Apparently this broad belt of rocky coast forms a definite limit to the eastward range of *maynardii* on the north.

In the south, *maynardii* is abundant as far as the drainage canal flowing from the Saltpond, one-half mile south of the Inagua Light Station. This pond is not to be confused with the great Central Lake. It is called "Saltpond" because commercial salt was formerly collected there. Farther south, and to the east along the south coast of Inagua the range of *maynardii* is broken by that of a new form which will be described below.

The burrows of *maynardii* are abundant along the western coast of the island. At Southwest Point many burrows in the sandy soil were excavated and all were found to be very shallow. No eggs of *maynardii* were found here or elsewhere on the island, although a special effort was made to obtain them. Under date of February 14, 1931, Klingel writes in his field book:

"Spent the morning excavating *Ameiva* burrows in the hope of procuring some eggs. Although some twenty burrows were excavated no eggs were found. From three of the burrows adult *Ameiva* were taken. None of the burrows were more than shallow holes in the ground, seldom exceeding a depth of a foot or a foot and one-half. All burrows were in gravelly or sandy soil, principally in sandy. There was no evidence of the elaborate construction such as is found in the burrows of *A. chrysolema*. The total absence of eggs or shells may be considered evidence either that the eggs were laid elsewhere or that the season is not appropriate. However, the presence of young would indicate that hatching must have occurred recently. Apparently we have not yet found the egg-laying site of this species or else the egg-shells have been destroyed soon after hatching."

Although *maynardii* is primarily a ground lizard, on five occasions individuals were seen to climb trees with ease and agility in search of food. In each case the lizards nosed into the corners of branches and leaves searching for insects. Movements of the lizards while in the trees were nervous and quick. One lizard was seen as high as six feet.

Another odd habit was noted in a number of specimens. While walking along the ground the lizards would suddenly stop, the hind legs, body and tail motionless, but continue the walking motion with the front legs. This action would keep up for half a minute at a time. The front legs touched the ground lightly or not at all. Apparently this was a form of exercise for it had no relation to the capturing of food or the digging of a burrow.

Ameiva maynardii uniformis, new subspecies

DIAGNOSIS.—Differs from the typical form only in coloration. Head and body uniform brown or grayish brown above, pale bluish gray or white below. Tail bluish gray, the tip or distal portion of each scale pale blue, the base and usually the greater part of each scale a dark bluish gray. In life, the blue tones are much brighter.

RANGE.—Southeastern half of the island of Great Inagua, B. W. I., as far west as Canfield Bay on the north and South West Point on the south.

TYPE.—A. M. N. H. No. 45404; adult male; Canfield Bay, Great Inagua Island; February 6, 1931; G. C. Klingel.

VARIATION.—*A. m. uniformis* is markedly different from the typical form in color. It was recognized at once in the field as a distinct form and special attention was given to working out its range on the island. Fifty-two specimens were collected, all from eastern and southern part of the island. Not a single specimen was seen north or west of a line drawn between South West Point and Canfield Bay. In this northwestern part of the island 105 specimens of *A. m. maynardii* were collected and many others were seen. In the southwestern part of the island there is some intergrading. Three intermediates were collected on South West Point and four on Salt Pond Hill. At Mathew Town *A. m. maynardii* is the only form present and was found ranging southward to the drainage canal which flows from the "Saltpond" a half mile south of the Inagua Light Station. From South West Point to Conch Shell Point, a distance of eight miles, *A. m. uniformis* is common to the exclusion of the typical form. *A. m. maynardii* appears again on the east side of Conch Shell Point and is common as far as Watering Bluff. From here eastward along the south coast *A. m. uniformis* occurs alone. Intermediates, therefore, were found only where the ranges of the two races meet; they are not uniformly distributed throughout the range of either form. As stated in the introduction the south and east sides of Great Inagua are decidedly more barren than the north and west sides. It is apparent that *uniformis* is a race restricted to the more barren coasts of the island.

In the specimens designated above as intermediate between *uniformis* and the typical form, the lateral stripes have begun to fade

at their extreme posterior end. In these the posterior part of the body is essentially like *A. m. uniformis* while the anterior part retains some evidence of the characteristic dark lateral stripe of *A. m. maynardii.*

If *uniformis* occured within the range of *maynardii* it would doubtlessly be regarded as a mutant not worthy of subspecific designation. It is interesting to note that where the range of *uniformis* overlaps that of the typical form, there is an intergradation of color pattern. It agrees, therefore, with other subspecies in having a distinct range and in intergrading with the typical form where their ranges overlap.

Tropidophus pardalis canus (Cope)

Ungalia cana Cope, 1868, Proc. Acad. Nat. Sci. Phila., p. 129.

Tropidophis pardalis canus Stull, 1928, Occ. Papers Mus. Zoöl. Univ. Mich., No. 195, p. 28.

Ten specimens of the only snake on Great Inagua were collected. They vary considerably in color. Stull (1928, p. 29), the most recent reviser of the group states:

"This subspecies may be distinguished from other forms of *pardalis* by its coloration (white or grayish yellow, as opposed to gray or brown)."

In our series the ground tone varies from a pale gray (A. M. N. H. No. 45838) to a brown (A. M. N. H. No. 45844). The dark spots may be dark brown or black. In several specimens the spotting is very poorly developed. In A. M. N. H. Nos. 45840 and 45844 there are no longitudinal stripes even on the sides of the neck. There is also considerable variation in the degree to which the scales are keeled. Two of the palest specimens have less keeling than the others. Nevertheless intergrades exist between the extremes of color and rugosity showing that *canus* is a much more variable race than hitherto assumed.

Habits.—The species was very common about Mathew Town where it was found principally under flat stones and decayed wood and boards. It emerged from its retreat after rainfall. Specimens were collected at Mathew Town, North West Point and Canfield Bay near North East Point. There was no evidence of the occurrence of this snake on the more barren east and south sides of Great Inagua, although probably it occurs there. Apparently the more heavily wooded areas are preferred.

Natives report the occurrence of this species on Sheep Cay, a small island near North West Point, but two trips failed to disclose any specimens from this locality.

The snake was seen devouring *Anolis* on several occasions and once it was observed eating a full-grown *Ameiva maynardii.* Insects, however,

probably form a large part of its diet. One specimen was taken from a hollow and decayed cocoanut tree. It was coiled in a little cavity about seven feet above ground. Its stomach was found to be full of small beetles and spiders.

REFERENCES

BARBOUR, THOMAS. 1930. 'The Anoles. I. The forms known to occur on the neotropical islands.' Bull. Mus. Comp. Zool., LXX, pp. 105–144.

1930*a*. 'A list of Antillean reptiles and amphibians.' Zoologica, XI, pp. 61–116.

BARBOUR, THOMAS, AND NOBLE, G. K. 1915. 'A revision of the lizards of the genus *Ameiva*.' Bull. Mus. Comp. Zool., LIX, pp. 417–479.

COCHRAN, DORIS M. 1931. 'New Bahaman reptiles.' Journ. Wash. Acad. Sci., XXI, pp. 39–40.

1931*a*. 'New reptiles from Beata Island, Dominican Republic.' Proc. Biol. Soc. Wash., XLIV, pp. 89–92.

COPE, EDWARD D. 1868. 'Additional descriptions of neotropical Reptilia and Batrachia, not previously known.' Proc. Acad. Nat. Sci. Phila., p. 129.

GANDOLFI, H. 1908. 'Ein sekundar Geschlechts unterschied bei *Lygosoma smarogdinum* Less.' Zool. Anz., XXXII, pp. 186–188.

GARMAN, SAMUEL. 1888. 'Reptiles and batrachians from the Caymans and the Bahamas.' Bull. Essex Inst., XX, pp. 1–13.

GRANT, CHAPMAN. 1931. 'The sphærodacytls of Porto Rico, Culebra and Mona Islands.' Journ. Dept. Agric. Porto Rico XV, pp. 199–222, Pls. XXVI–XXVII.

1931*a*. 'A new species of *Aristelliger* from Navassa.' Journ. Dept. Agric. Porto Rico, XV, pp. 399–400, Pl. XLVIII.

KLINGEL, G. C. 1932. 'Shipwrecked on Inagua.' Nat. Hist., XXXIII, pp. 42–55.

NOBLE, G. K. 1921. 'The bony structure and phyletic relations of *Sphærodactylus* and allied lacertilian genera, with the description of a new genus.' Amer. Mus. Novitates No. 4, pp. 1–16.

SCHMIDT, K. P. 1926. 'The amphibians and reptiles of Mona Island, West Indies.' Field Mus. Nat. Hist., Publ. 236, Zoöl. Series XII, pp. 149–163.

STULL, OLIVE. 1928. 'A revision of the genus *Tropidophis*.' Occas. Pap. Mus. Zoöl., No. 195, pp. 1–49, Pls. I–III.

VAUGHAN, T. W. 1919. 'Fossil corals from Central America, Cuba, and Porto Rico, with an account of the American Tertiary, Pleistocene and Recent coral reefs.' U. S. Nat. Mus. Bull., No. 103, pp. 189–524, Pls. LXVIII–CLII.

West Indies Pilot. 1927. Fifth Ed., I, Hydrographic Office Publ. No. 128, Washington, D. C.

AMERICAN MUSEUM NOVITATES

Number 550 | Published by The American Museum of Natural History New York City | August 15, 1932

59 57,2 11 82

EXPERIMENTS WITH ORTHOPTERA CONCERNING DIURNAL RHYTHM

By Frank E. Lutz

Broadly speaking, insects may be grouped as to whether they are diurnal or nocturnal. Possibly all species have at least a trace of diurnal rhythm in their activities but, even where there is a marked rhythm, we have very few accurate data concerning its extent and especially concerning its persistence under changed conditions.

The data presented here were obtained quite simply by means of a homemade recording apparatus. The insects to be tested were put in a cage having a small compartment at each end. These compartments were connected by a narrow runway and in the middle of this runway was a delicately counterbalanced treadle. When an insect crossed the treadle the insect's weight depressed the treadle so that wires at the ends of the treadle dipped into mercury, completing an electric circuit through an electromagnet. This magnet pulled aside a recording pen which was otherwise tracing a straight line on adding-machine paper. The paper used was wide enough to accommodate six of these pens and was kept moving at a constant rate by, according to circumstances, either an eight-day spring clockwork or a motor such as is used in electric clocks. The ink reservoir of each pen (both homemade) was of such a size that the supply of ink was sufficient for recording during several days of enforced absence of the experimenter. The movement of the paper was regulated to be about three inches per hour. When the motor clockwork was used the movement of the paper did not appreciably vary but it did vary when the spring clockwork was used. In the latter case, one of the pens was used to mark the hours, being electrically controlled from a more accurate eight-day clock. Unless otherwise stated, only one insect at a time was used in a given cage.

The graphs presented in this connection are made from the accompanying tables. In the tables "average daily activity" is the average number of times the insect crossed the treadle in either direction in a day. The number of days and fractions of a day upon which this average is actually based may be found from the "number of hours recorded" column. This number of days does not always correspond with the

length of the experiment because of occasional trouble with the recording device. For the purpose of presenting the diurnal rhythm data the day is divided into twelve two-hour periods as shown, and the average amount of activity in each period is given as percentages of the average daily activity.

If there were no diurnal rhythm, if the activity were evenly distributed throughout the day, there would, of course, be 8.3 per cent activity in each two-hour period. This 8.3 per cent line of random activity is shown in the graphs as the upper margin of the strip that indicates the conditions of light.

Dense shading in the basal part of a graph indicates darkness at the corresponding period of the day. No shading indicates full illumination. When there was normal transition from daylight to night-darkness and back to daylight this is indicated by a gradual increase and decrease of shading but no attempt has been made to have the degree of shading correspond to the actual amount of light in the case of normal day-night changes of illumination.

The darkness indicated in the experiments with "constant darkness" and with "reversed illumination" was obtained by having the apparatus in a dark room of the cellar of my home. Incidentally, this gave also conditions of practically constant humidity and temperature. At no time did the temperature of this room vary two degrees centigrade within twenty-four hours and rarely more than one degree. "Reversed illumination" was obtained in the cellar by turning on strong electric lights at 8 P.M. and turning them off at 6 A.M. standard time.

Gryllus domesticus

This European House-cricket, now rather widely distributed in America, was being used for another purpose in an apparatus similar to that just described. The following data are, then, in the nature of by-products of the other work.

It will be seen from figure 1 and table 1 that, although nocturnal insects, the activities of this species, whether mature or immature, male or female, take place chiefly between 7 P.M. and midnight, with a definite peak at about 9 P.M.

Figures 2 to 4 and table 1 present three experiments in which we have activity data for the same individuals in normal illumination and in constant darkness, while figure 5 gives similar data for a combination of experiments. Clearly, the normal diurnal rhythm of activity is something which is fixed enough to persist rather definitely in constant

Experiment	Dates	Light	Average Activity, Per Cent												Average Daily Activity	Number of Hours Recorded
			Noon 2 PM	2 PM 4 PM	4 PM 6 PM	6 PM 8 PM	8 PM 10 PM	10 PM Mid.	Mid. 2 AM	2 AM 4 AM	4 AM 6 AM	6 AM 8 AM	8 AM 10 AM	10 AM Noon		
330 G Immat.	Mch. 30 Apr. 3	N	5.2	0.8	1.4	16.7	46.7	15.6	3.3	4.4	0.3	0.0	0.0	5.6	89 92	84
	Apr. 3 Apr. 12	D	2.3	1.9	0.2	14.3	29.3	21.5	14.3	4.9	8.5	1.2	0.3	1.2	122.96	170
413 G Immat. Males	Apr. 13 Apr. 17	N	8.4	8.4	7.0	21.0	22.9	18.3	6.5	1.2	0.0	0.9	3.3	1 9	53 42	92
413 G Immat. Females	Apr. 13 Apr. 17	N	0.0	1.4	0.0	23.9	38.8	27.5	5.6	0.0	0.0	1.4	0 0	1 4	35 50	92
420 G Males	Apr. 20 Apr. 26	N	1.0	3.4	6.3	23.6	29.5	14.0	9.7	4.3	2.2	0.0	4.3	1.7	41.42	125
420 G Females	Apr. 20 Apr. 26	N	0.6	4.5	3.2	13 5	27.1	21 0	11 3	8.1	3.8	0.5	3 5	2 4	61 94	134
729 G Immat.	July 30 Aug. 1	N	0.0	0.0	0.0	0.8	20.0	25.6	22.4	18.8	10.8	0.0	0.8	0 8	125 00	37
	Aug. 1 Aug. 8	D	7.0	5.2	5.2	8.9	11.5	15.4	13.6	9.2	8.7	3 9	6.0	5 5	135 06	165
723 G Immat.	July 25 Aug. 1	N	5.5	3 5	3.3	4.1	11.7	28.5	18.0	6.0	6.3	1.5	2 4	9 2	61 04	143
	Aug. 1 Aug. 8	D	14.8	9.5	10.3	14.5	13 1	19.5	1.6	5.0	0.6	2.5	2 2	6.6	45 84	156
802 G Immat.	Aug. 2 Aug. 8	D	8 6	12.1	13.1	10 1	14.9	12.5	9 3	6.1	3.7	0.8	1.6	7.3	49.56	114
	Aug. 8 Aug. 13	D	7.7	21.2	14.4	12.5	12.8	2.4	0.0	1.9	12.8	3.9	1.9	8.5	20.78	112

darkness, temperature, and humidity. There is, however, a noticeable tendency to spread the activity into hours in which there was normally very little and this spreading of course decreases the height of the activity peak.

I have not found any satisfactory numerical index of concentration of activity and neither have I been able to calculate the probable error of the position of the peak. My difficulty seems to be to start or stop a curve that is really on a circular base-line, the diurnal cycle of time. One

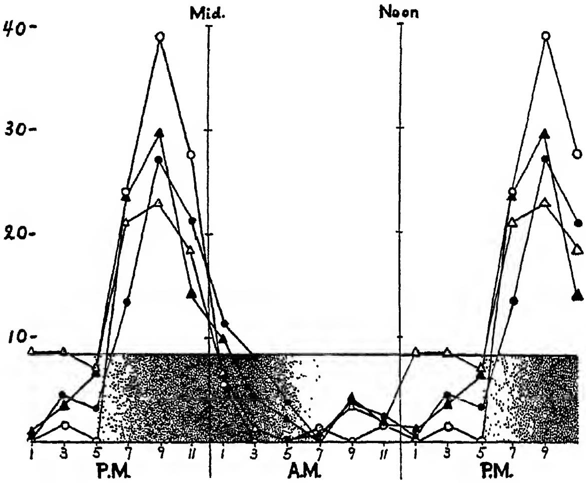


Fig. 1.—Activity Curves of *Gryllus domesticus* in Normal Day-Night Conditions Triangles, males; circles, females; open, immature; solid, mature. See Table 1, 413 G and 420 G.

can calculate the center of distribution of a circular graph but, having done that, it does not seem to be quite as satisfactory as a direct visual comparison of the curves.

Gryllus assimilis

This is the common black Field-cricket of America. Table 2 and figures 6 to 9 show that, like *G. domesticus*, it has a very definite diurnal rhythm that is maintained with no clearly significant change for at least two weeks in constant darkness, temperature, and humidity.

Four experiments (see Table 2 and Figs. 10 to 12) had to do with the effect of "reversed illumination," namely light from 8 P.M. to

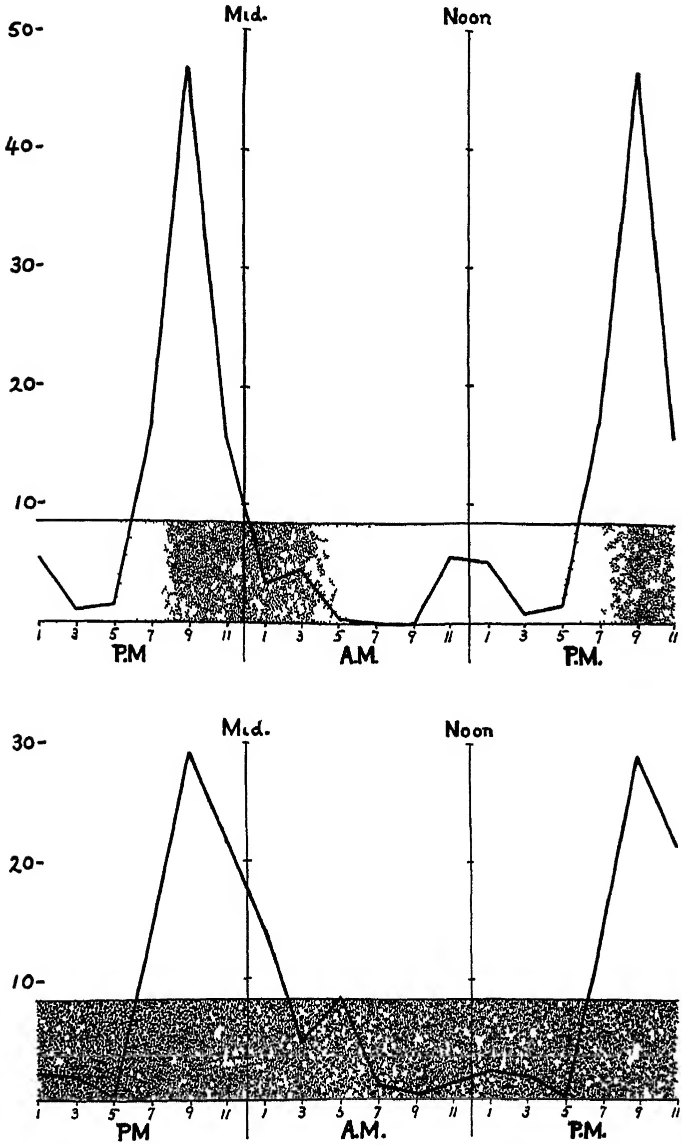


Fig 2 —Activity Curves of an immature *Gryllus domesticus* in Normal Day-Night Conditions and in subsequent Constant Darkness See Table 1, 330 G

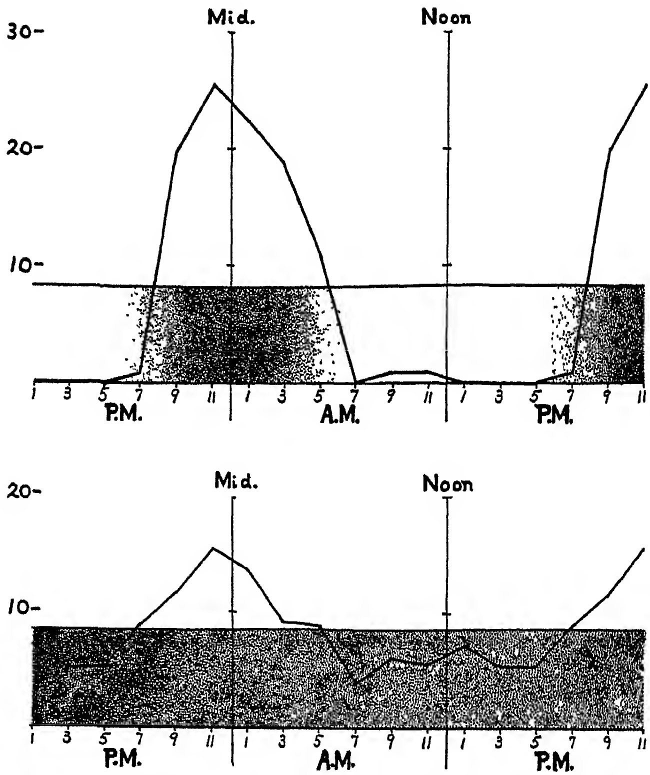


Fig. 3.—Activity Curves of an immature *Gryllus domesticus* in Normal Day-Night Conditions and in subsequent Constant Darkness. See Table 1, 729 G.

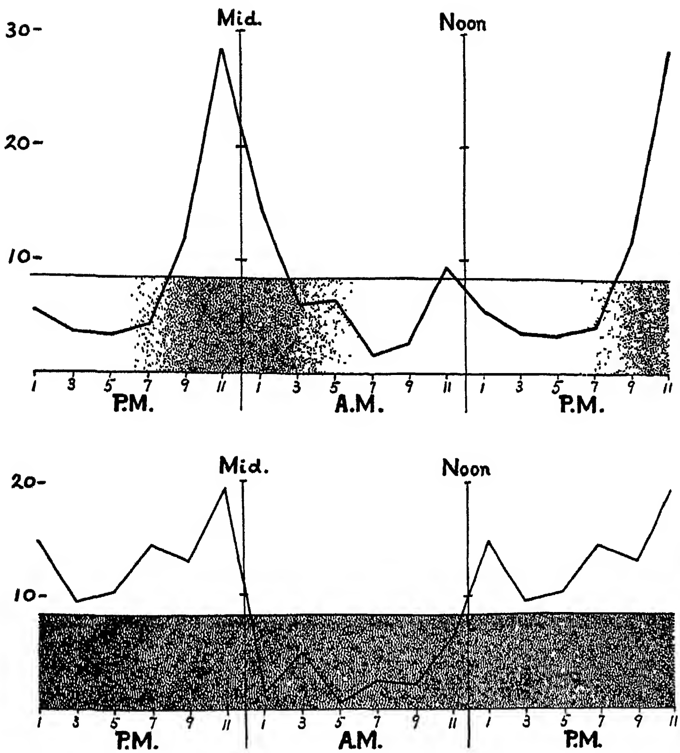


Fig. 4.—Activity Curves of an immature *Gryllus domesticus* in Normal Day-Night Conditions and in subsequent Constant Darkness. See Table 1, 723 G.

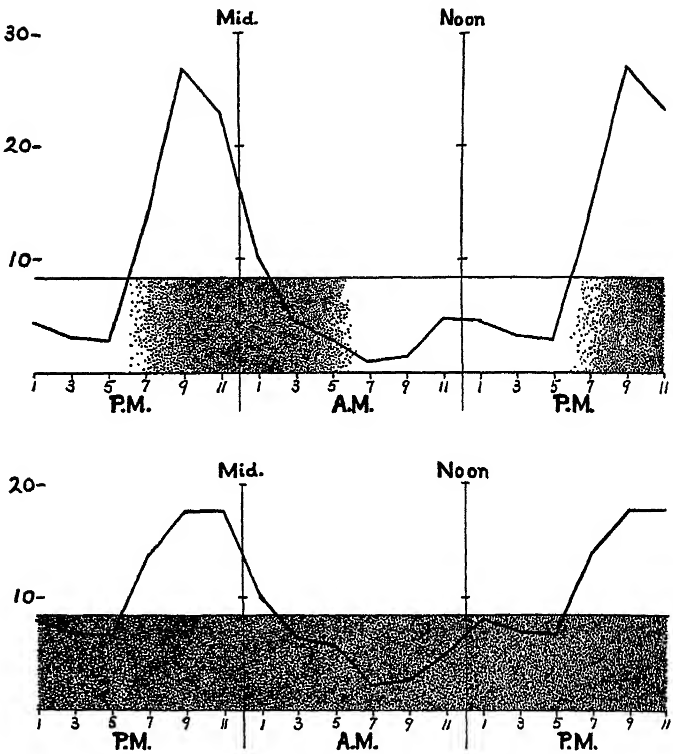


Fig. 5.—Activity Curves, weighted by number of recorded hours, of several immature *Gryllus domesticus* in Normal Day-Night Conditions and in subsequent Constant Darkness. See Table 1, 330 G, 413 G, 729 G, and 723 G.

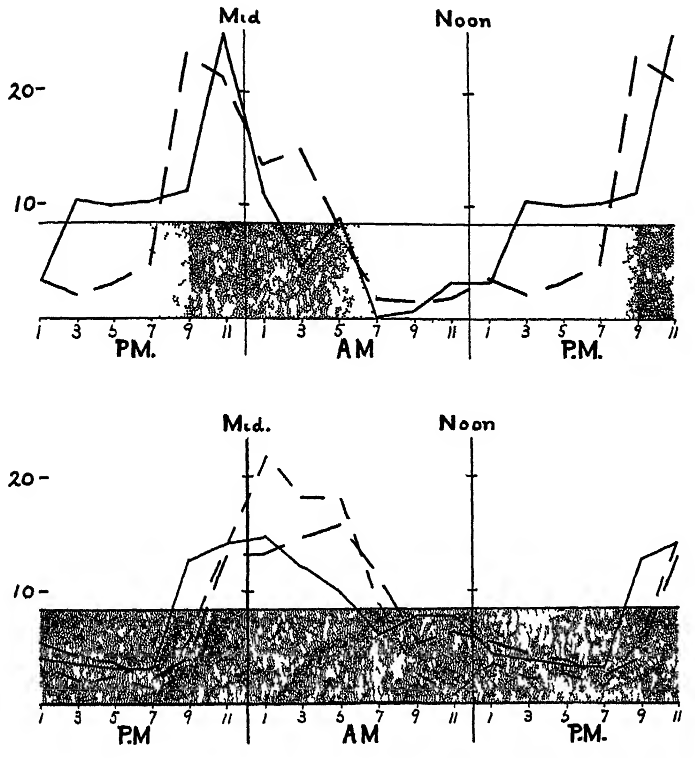


Fig 6 —Activity Curves of a male *Gryllus assimilis* in Normal Day-Night Conditions and in subsequent Constant Darkness See Table 2, 829 G1 Solid lines indicate first time-groupings, long dashes, second, and short dashes, third

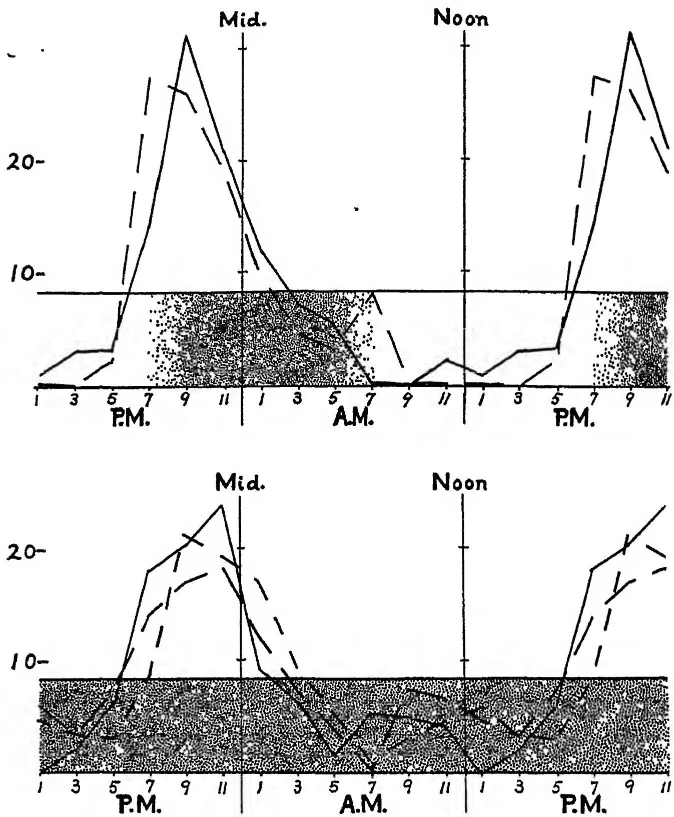


Fig. 7.—Activity Curves of a male *Gryllus assimilis* in Normal Day-Night Conditions and in subsequent Constant Darkness. See Table 2, 829 G2. Solid lines indicate first time-groupings; long dashes, second; and short dashes, third.

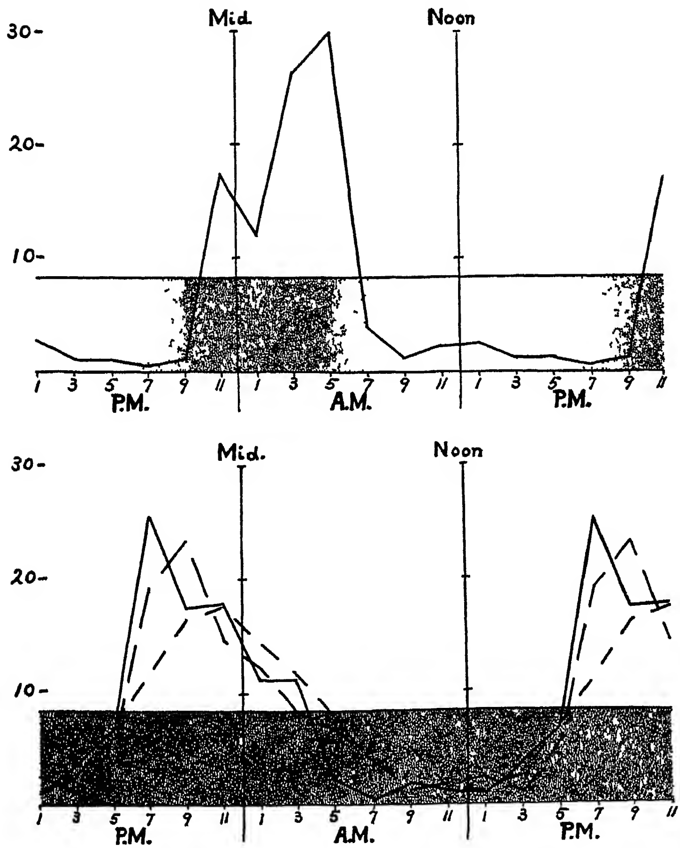


Fig. 8.—Activity Curves of a male *Gryllus assimilis* in Normal Day-Night Conditions and in subsequent Constant Darkness. See Table 2, 910 G1. Solid lines indicate first time-groupings; long dashes, second; and short dashes, third.

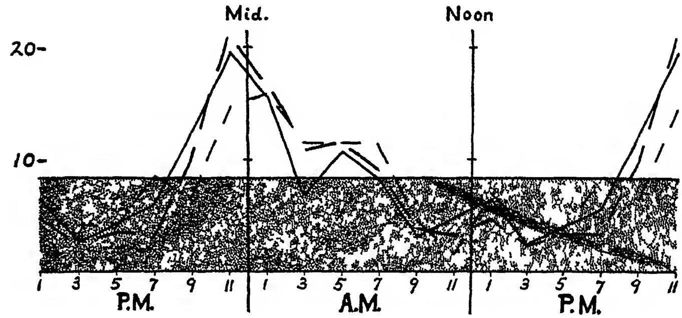


Fig. 9.—Activity Curves of a male *Gryllus assimilis* in Constant Darkness following normal conditions. See Table 2, 914 G1. Solid lines indicate first time-grouping; long dashes, second; and short dashes, third.

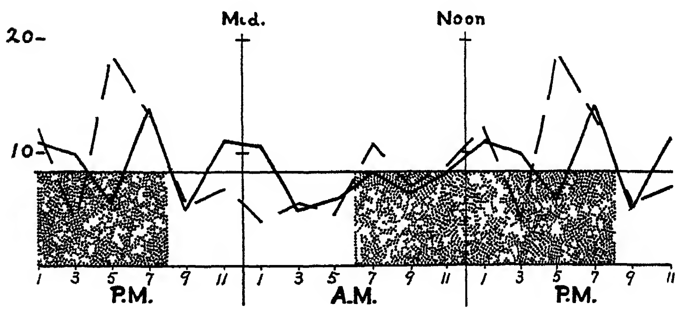


Fig 10.—Activity Curves of a male *Gryllus assimilis* in "Reversed Illumination" after having been in constant darkness. Solid line indicates the first six days; and the broken line the second. See Table 2, 830 G1.

6 A.M. and darkness during daytime, temperature and humidity being constant.

The male 830 G1 had been in constant darkness for sixteen days (during which time it matured) before it was subjected to reversed illumination and so, were it not for the experiments just mentioned, might have been supposed to have lost some of its normal diurnal rhythm. Unfortunately, we do not have data on this point. Its activities (see

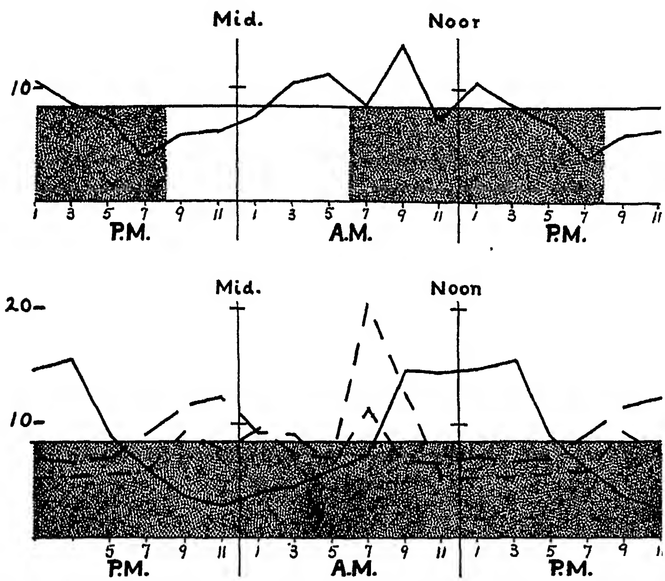


Fig. 11.—Activity Curves of a male *Gryllus assimilis* in "Reversed Illumination" (following normal conditions) and in subsequent Constant Darkness. See Table 2, 905 G1. Solid lines indicate first time-groupings; long dashes, second; and short dashes, third.

Fig. 10) for the first six days of reversed illumination were almost random but with indications of one peak at the normal time near midnight (now light) and another toward the end of the daily period of artificial darkness. In the second six days it had lost its normal peak and increased its new peak.

The males 905 G1 and 906 G1 were transferred directly from normal illumination to reversed. The former male was kept in reversed illumination for five days and the latter for only four. Both (see Figs. 11 and 12) showed a shift of activity peak in this short time. Since the data given

TABLE 2.—CONDENSED STATEMENT OF DATA CONCERNING *GRYLLUS ASSIMILIS*

Experiment	Dates	Light	Average Activity, Per Cent												Average Daily Activity	Number of Hours Recorded
			Noon 2 PM	2 PM 4 PM	4 PM 6 PM	6 PM 8 PM	8 PM 10 PM	10 PM Mid.	Mid. 2 AM	2 AM 4 AM	4 AM 6 AM	6 AM 8 AM	8 AM 10 AM	10 AM Noon		
829 G1 Male	Aug. 29 Sept. 5	N	3.3	10.6	10.0	10.3	11.3	25.2	11.3	4.7	9.0	0 3	0.7	3.3	30.10	152
	Sept. 5 Sept. 12	N	3.4	2 1	3.2	4 0	23.3	21.2	13.6	15.0	8.2	1.9	1.6	1.7	95.50	165
	Sept. 12 Sept. 17	D	4.4	3.7	3 3	3.2	12.8	14.2	14.7	12.1	9.8	6.1	7.9	7.7	113.98	106
	Sept. 17 Sept. 22	D	5.5	4.2	3.8	2 3	4.2	13.1	13.3	14.8	15.9	11.2	5.3	6.3	94 60	120
	Sept. 22 Sept. 27	D	3.6	2.2	2.5	1 4	5.9	14.2	21 7	18.3	18.1	8.8	2.6	0.7	90.98	95
829 G2 Male	Aug. 29 Sept. 5	N	0 9	3.0	3 2	14.4	31.2	20 9	11.8	7 0	5.3	0.2	0 0	2 1	67.56	157
	Sept 5 Sept. 12	N	0 2	0.0	2.2	27.3	25 8	18.9	9 4	4 4	3.2	8.1	0.2	0.2	57.04	159
	Sept. 12 Sept. 17	D	0.0	2.0	5.9	17.7	20.0	23 6	9.1	6.2	1.5	5.2	4.8	4.2	67.92	96
	Sept. 17 Sept. 22	D	4.6	3.3	7.1	13.8	16.7	18.0	11.7	7.1	3.7	0 2	7.3	6.4	134 48	114
	Sept. 22 Sept. 27	D	5.7	3.3	2.8	8.6	20 9	19 0	16.6	9 2	5.3	1.0	3.0	4.6	126.16	86

910 G1 Male	Sept. 10 Sept. 12	N	2.9	1.2	1.2	0.6	1.2	17.3	12.0	26 3	29.8	4.1	1.2	2.3	171 20	36
	Sept. 12 Sept. 17	D	1.0	3 5	6.7	25.5	17.5	17.8	11.3	11 0	2 3	0.4	1.8	1.2	165.48	100
	Sept. 17 Sept. 22	D	2.5	1.0	5.4	19 2	23.3	14.5	12.0	8.2	6.9	3 8	1.3	1 9	63.40	120
	Sept 22 Sept. 27	D	1.2	2.6	7.0	11.6	16.3	17.5	14.3	11 4	8 0	3.5	5.0	1.5	99 60	114
914 G1 Male	Sept. 15 Sept. 20	D	6.5	2.6	4.2	5.8	12.2	19.6	15 4	6.9	10.6	8.3	3.2	4.8	37 76	118
	Sept. 20 Sept. 25	D	4.7	2.5	3.5	3.3	10.1	21.1	16.6	10.8	11 4	9 0	3 8	3.2	98.76	107
	Sept. 25 Sept. 30	D	7.0	4.1	3.8	8.4	6.5	14.4	15.7	11 2	11 5	11.3	4 4	1.6	73 78	107
901 G1 Female	Sept 1 Sept. 12	N	7.9	4.2	7.9	21.7	13 8	14 8	9.5	6.3	6 9	2 1	3 7	1 1	18 90	240
	Sept. 12 Sept. 17	D	12.5	8.2	10.3	1 4	7.6	9.0	14 4	6.1	3.6	10 1	12.0	4.8	69 38	83
	Sept. 17 Sept. 22	D	9.7	8 2	4.1	10.2	6.6	10.2	5.1	7.7	2.6	9 2	14.8	11.7	39.20	120
	Sept. 22 Sept. 27	D	12.8	7.2	5.0	5.6	10.6	11.1	1.7	3 9	10.0	10.5	9.1	12 5	35.92	114

905 G2 Female	Sept. 8 Sept. 12	R	5.3	4.3	10.6	17.6	18.6	12.2	6.4	1.6	2.7	5.3	14.4	1.1	47.06	96
	Sept. 12 Sept. 18	D		Inactive from 9:00 A.M. Sept. 13 to 5:00 P.M. Sept. 17												144
	Sept 18 Sept. 24	D	9.4	10 2	10.7	7.2	8 5	17.1	9.0	6.9	2.7	3.1	6.3	8 9	118.00	141
	Sept. 24 Sept. 30	D	6.1	7 9	7.2	8.3	18 7	14 9	7.5	6 7	4.6	4.6	5.0	8 5	104.18	133
905 G3 Female	Sept. 5 Sept. 12	N	13 6	10.7	3 0	10 7	7.2	11 1	8.9	9.8	6.0	6.8	7.7	4.6	33.58	164
	Sept. 12 Sept. 17	D	10.1	7.2	2.1	5.8	12 3	5.1	4.3	7 2	5 1	6 4	11.8	22.6	27.66	102
	Sept. 17 Sept 22	D	8 3	4.2	0.6	10 1	12.5	13 1	13.7	4.8	7.1	5.4	7.1	13.1	33.60	120
	Sept. 22 Sept. 27	D	11.8	5.9	3.7	5.2	13 3	20.0	8 9	8.9	6.7	3.7	2.8	9.2	27.06	114

are averages for the WHOLE period, the tendency during the first day or two to be active at the normal time accounts for considerable of the activity then. Each was then transferred to constant darkness, temperature, and humidity, where for the first four days each kept true to the newly gained time of activity but then each, particularly 906 G1, went

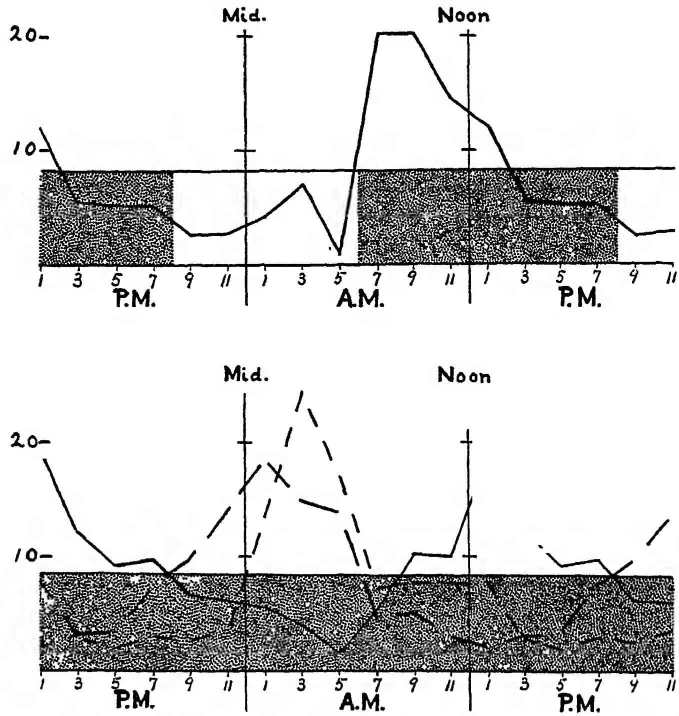


Fig. 12.—Activity Curves of a male *Gryllus assimilis* in "Reversed Illumination" (following normal conditions) and in subsequent Constant Darkness. See Table 2, 906 G1. Solid lines indicate first time-groupings; long dashes, second; and short dashes, third.

back to the old normal time of activity. It may be significant that 906 G1, which had been subjected to reversed illumination for only four days, went back more completely than 905 G1, which had been given five days of reversed illumination and which retained a peak at the time at which the artificial darkness had been begun.

The experiment with a female, 905 G2, was somewhat spoiled by the fact that she was inactive for much of the first five days of darkness

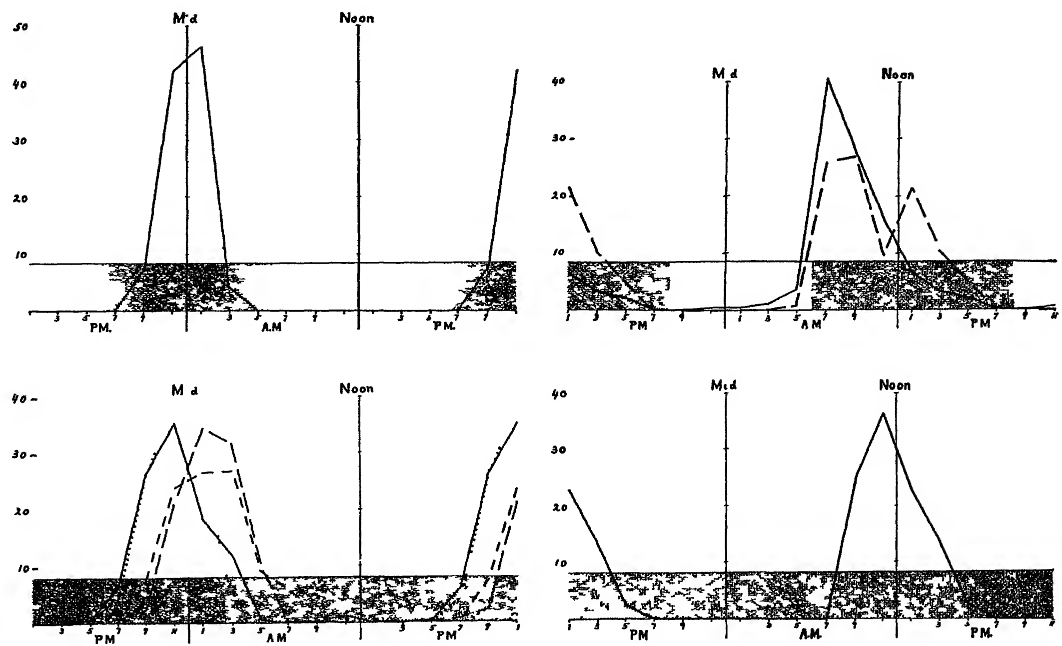


Fig 13 —Activity Curves of a *Stenopelmatus* in successively Normal Day-Night Conditions, Constant Darkness, "Reversed Illumination," and Constant Darkness See Table 3, 729 A Solid lines indicate first time-groupings, long dashes, second; short dashes, third, and dots, fourth.

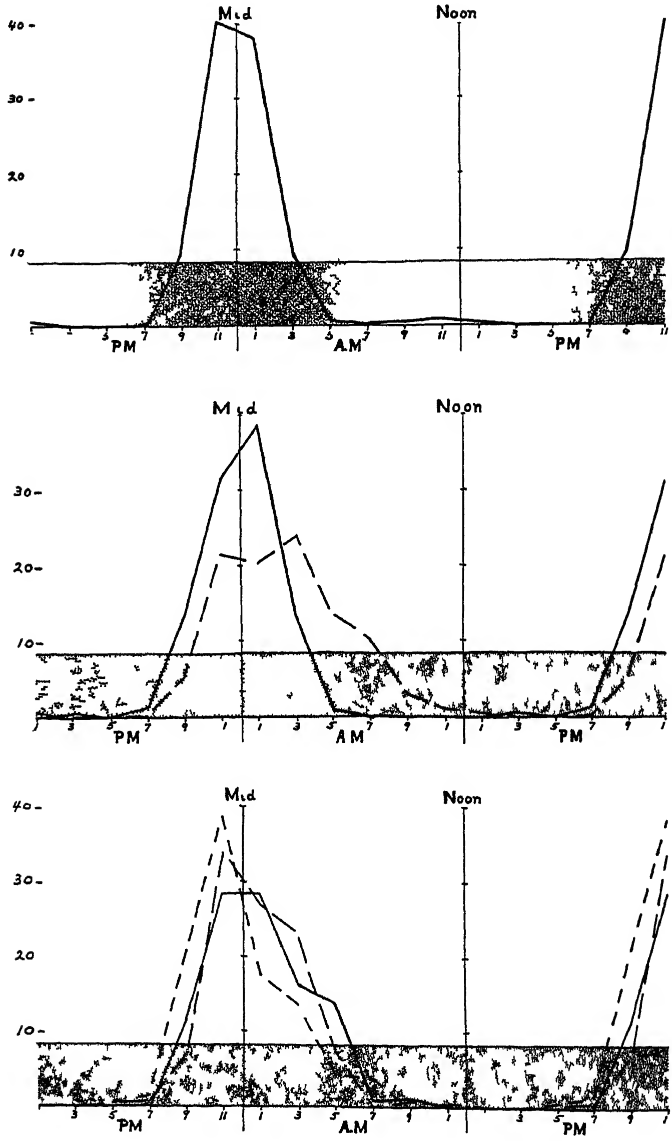


Fig 14—Activity Curves of a *Stenopelmatus* in Normal Day-Night Conditions and subsequent Constant Darkness; also Constant Darkness following an inactive period in "Reversed Illumination" See Table 3, 723 S1 Solid lines indicate first time-groupings; long dashes, second, and short dashes, third

following reversed illumination. However, in this connection see the following experiments with *Stenopelmatus.*

Stenopelmatus

This orthopteron is a wingless, photo-negative "long-horned grasshopper," but during the day and usually during the night also it lives in subterranean burrows. It is a native of southern California, where it is called "Jerusalem Cricket" (although not a cricket) and "Baby Face."

When specimens were brought from the Pacific to the Atlantic coast, using them to study diurnal activity was not anticipated. There is a difference of three hours in standard time at these places and, since the insects had been living for about a month in Eastern Standard Time before they were tested, one can not be certain that the diurnal rhythm shown in table 3 and figures 13 and 14 is not influenced by a previous existence in Pacific Coast Time.

However, it is remarkable that a creature which normally lives in constant darkness should show such a definite diurnal rhythm when subjected to diurnal light-changes, and it seems even more remarkable that such a rhythm should be kept up in subsequent constant darkness.

Much trouble was experienced with these creatures, owing to their dragging earth and food on to the treadle and thus weighting it down with the result that the recording pen was held at the "active" position. As this usually occurred at night and was not remedied until morning, many hours of record were lost. Experiments 723 S1 and S2 were with individuals. There were two individuals in the 729 A cage until August 23, when one of them died.

As in the experiments with the crickets, the compartments at the ends of the cages were made of tin and had a tin cover. Therefore, when the apparatus was in the light these compartments were relatively dark, being illuminated only through the opening connecting with the wire-gauze runway. This fact might be supposed to explain the definite lack of *Stenopelmatus* activity during daylight hours, but it does not explain the continuance of such a marked diurnal rhythm for at least a month of constant darkness, temperature, and humidity.

There is a very interesting, and perhaps significant, comparison to be made between 723 S1 and 729 A when subjected to reversed illumination. Each experiment was with a single individual since one of the two in 729A had died before reversed illumination was started.

Under reversed illumination the 729 A individual shifted its peak of activity from near midnight to the time of mid-day darkness and sub-

TABLE 3.—CONDENSED STATEMENT OF DATA CONCERNING *STENOPELMATUS*

Experiment	Dates	Light	Average Activity, Per Cent												Average Daily Activity	Number of Hours Recorded
			Noon 2 PM	2 PM 4 PM	4 PM 6 PM	6 PM 8 PM	8 PM 10 PM	10 PM Mid.	Mid. 2 AM	2 AM 4 AM	4 AM 6 AM	6 AM 8 AM	8 AM 10 AM	10 AM Noon		
723 S1	July 23 Aug. 1	N	0.4	0.0	0.0	0.0	9.4	40.1	38.1	9.7	0.7	0.2	0.4	0.7	69.62	177
	Aug. 1 Aug. 8	D	0.0	0.4	0.0	1.1	13.6	31.5	38.8	13.9	0.7	0.0	0.0	0 0	39.01	165
	Aug. 8 Aug. 15	D	0.7	0.0	0.1	0.2	5.6	21.6	20.1	23.9	13.7	10.3	2.9	0.8	124.86	168
	Aug. 15 Aug. 30	D	Inactive, making only five trips													360
	Aug. 30 Sept. 12	R	Practically inactive, making only 66 trips													283
	Sept. 12 Sept. 19	D	0.0	0.0	0.0	0.0	11.4	28.5	28.4	16.3	13.6	0.7	1.0	0.0	27.56	150
	Sept. 19 Sept. 25	D	0.0	0.0	0.0	0.5	7.1	33.9	27.2	23.1	7.1	0.0	0.7	0.3	98.32	128
	Sept. 25 Oct. 1	D	0.0	0.0	0.4	1.6	21.1	38.7	17.8	13.5	4.3	2.1	0.0	0.5	40.78	129
723 S2	July 23 Aug. 1	N	2.5	0.0	0.0	3.0	33.4	40 7	12.6	0.2	0.8	3.0	0.3	3.5	61.10[1]	149
	Aug. 1 Aug. 8	D	1.6	3.6	2.0	1.6	4.9	3.3	18.0	57.1	7.9	0.0	0.0	0.0	10.16	136
	Aug. 8 Aug. 15	D	0.0	0.0	0.0	1.7	1.1	34.1	43.2	17.0	0.0	2.2	0.6	0.0	24.68	151

sequently it kept its new peak of activity during six days of constant darkness. Unfortunately, it then died.

The 723 S1 individual became inactive for some unknown reason after two weeks of constant darkness following normal daylight and remained relatively inactive during the twelve days during which it was subjected to reversed illumination. It resumed activity in the subsequent constant darkness, but its peak of activity was that of normal daylight, showing no effect of reversed illumination. This type of diurnal rhythm was kept up to the end of the experiment although that was two months after it had last been subjected to normal daylight and although it had meanwhile been through a period of reversed illumination.

SUMMARY

There seems little to be gained at the present time in doing more than presenting the results of these experiments. Two species of crickets and a subterranean grasshopper showed very definite diurnal rhythms which were continued in constant darkness, temperature, and humidity. These rhythms were changed by "reversed illumination" and then the new rhythms were continued in constant darkness with the following exceptions. The crickets that were subjected to reversed illumination for only a short time showed a tendency to return to the old rhythm after a short time in constant darkness, and the *Stenopelmatus* individual that was inactive during a relatively long period of reversed illumination showed no effect of the reversing when it was subsequently active in constant darkness.

AMERICAN MUSEUM NOVITATES

Number 551 | Published by The American Museum of Natural History, New York City | August 15, 1932

59.7 (729.6)

AN ANNOTATED LIST OF FISHES FROM LAKE FORSYTH, ANDROS ISLAND, BAHAMAS, WITH THE DESCRIPTIONS OF THREE NEW FORMS

By C. M. Breder, Jr.

The following list of eleven species of fishes occurring in Lake Forsyth, Andros Island, Bahamas, is in the nature of a preliminary taxonomic list on the first collection of fishes from that locality. It is to be followed by a full discussion of the ecological relationships in this peculiar, isolated lake of fresh water inhabited by marine types. The material was collected by the Bacon-Andros Expedition in February, 1932, the other results of which are in preparation.

Cyprinodon baconi, new species

Type No. 10107, American Museum of Natural History.

Standard length, 27 mm.; total length, 33.5. Head, 3.0; depth, 2.3; dorsal, 9½; anal, 9½; scales, 21. Body short, compressed; snout broad, 3.0 in head; eye, 3.2; interorbital, 3.2; mouth small, oblique, superior; teeth in jaws a single row of

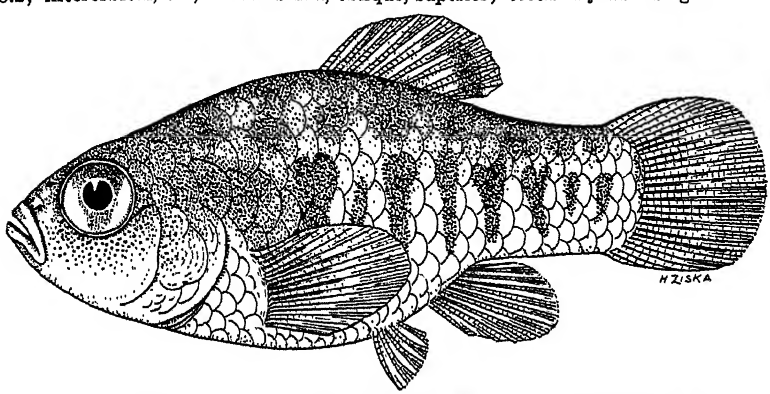


Fig. 1. *Cyprinodon baconi*, new species. Type, 27 mm. standard length.

tricuspid incisors; maxillary, 4.0. Humeral scale large; distance from its posterior edge to head equal to distance from front of eye to posterior edge of pupil; caudal peduncle 2 in head; dorsal base 2.2 in head, its longest ray falling short of root of tail by an equal distance; origin of anal scarcely in advance of end of dorsal base; caudal slightly rounded. This fish, an unripe female, shows the following pattern: body

crossed by seven broken, dark, vertical bars, the ground color silvery below and light tan above; fins plain except dorsal which has a small black spot on its posterior part, smaller than pupil.

There are forty-six paratypes of from 12 to 24 mm. in standard length.

Named for Mr. Daniel Bacon, the sponsor of the expedition that made this collection possible.

The pattern of the males is similar to that of the females, except that the males lack the dorsal spot and the underparts are bright orange instead of silvery. The young immature fish all show the dorsal spot and it disappears in the males at about a standard length of 24 mm. The scales are very weakly ciliated in the larger males, possibly none of which are fully matured.

Although this genus is clearly in need of a thorough revision, the present species is certainly distinct from any thus far known. It clearly belongs to the *C. variegatus-riverendi-dearboni* group with its enlarged humeral scale and pattern in both sexes not unlike that of the females of these others. It differs distinctly from those species and all others in the small scale count 21 ± 1 as against 24 to 26 in the others of this group, in the slight amount of sexual dimorphism, and the dwarf size at which maturity is reached. The type represents the largest specimen collected or seen.

The West Indian species of *Cyprinodon* may be separated by the following tentative key.

A. Humeral scale larger than the others; dorsal, 9 to 11; depth, 2.0 to 2.6; scales 20 to 26.

B. Scales, 24 to 26; head, 2.7 to 3.6; sexual dimorphism well marked.

C. Scales, 26; anal of male not edged with black; depth, 2.0 to 2.6; head, 3.25 to 3.4; (Cape Cod to Rio Grande)..........*C. variegatus* Lacépède.

CC. Scales, 24; anal of male edged with black.

D. Depth, 2.0; head, 3.3; coloration light, not nearly black; (Cuba and Florida. Keys).......... ....*C. riverendi* (Poey).

DD. Depth, 2.1 to 2.5; head, 2.7 to 2.9; coloration dark, nearly black; (Curacao). *C. dearborni* Meek.

BB. Scales, 20 to 22; head, 2.7 to 3.0; sexes similar in pattern except for female dorsal spot; (Andros Island)........................*C. baconi*, n. sp.

AA. Humeral scale little if at all enlarged; dorsal 9 to 12; depth, 2.75 to 4; scales, 26 to 30.

E. Depth, 2.75; dorsal, 12; scales, 30; (Cuba).............*C. felicanus* (Poey)

EE. Depth, 4; dorsal, 9; scales, 26; (Santa Marta, Colombia). *C. martæ* Steindachner.

Gambusia manni Hubbs

Common but not abundant in places little or not at all frequented by larger species. Generally found in small lakeside pools of from about one foot in diameter upward. These are subject to rapid diurnal changes in temperature, as well as in chemical composition, due to sudden showers.

Strongylura notata forsythia, new subspecies

Type No. 10108, American Museum of Natural History.

Standard length, 245 mm.; total length, 269 mm.; depth, 1.4 in postocular part of head. Head, 2.5; pectoral in postocular part of head, 1.1; ventral in postocular part of head, 2.0; eye in postocular part of head, 2.15; snout, 1.55; interorbital in postocular part of head, 2.2; width of head in postocular part of head, 1.3; width of body in postocular part of head, 1.5; depth of peduncle in eye, 1.5; dorsal base in postocular part of head, 0.85; anal base in postocular part of head, 0.95; longest dorsal ray in postocular part of head, 1.1; longest anal ray in postocular part of head, 1.05; lower caudal lobe in postocular part of head, 0.8; anal base in dorsal base, 1.1.

Dorsal, 14; anal, 14; lateral line about 145; predorsal scales about 95; ventral insertion midway between base of caudal and head. Head broad and flat above, its depth 0.95 in width; postocular part of head 4.2 in head.

Coloration as in *S. n. notata*, but red on dorsal, anal and caudal fainter and body with a general tendency to less brilliancy than in the marine form.

There are twenty-one paratypes of from 105 to 237 mm. in standard length.

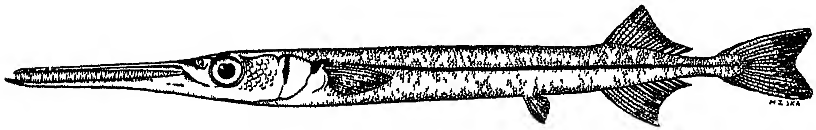


Fig. 2. *Strongylura notata forsythia*, new subspecies. Type, 245 mm. standard length.

Named for the only region in which it is known to occur.

This fish has been given subspecific status for the following reasons. Compared with material from Key West and Chub Cay, Bahamas, certain measurements show a progressive shift in averages and extremes suggesting proportional changes as one moves eastward from Key West to Chub Cay and then southward to Lake Forsyth.

It will be noted in the accompanying tabulation of measurements that in progressing from left to right the averages of the first two measures are in a descending order and that in the last two measures the Chub Cay fishes are high, descending to either side. The minimum values for all descend from right to left or at least drop in the lake Forsyth

MEASUREMENTS

	12 Specimens Key West			8 Specimens Chub Cay			13 Specimens Lake Forsyth		
	Min.	Aver.	Max.	Min.	Aver.	Max.	Min.	Aver.	Max.
Eye+Postorbital part of head in head	*3.20*	3.33	*3.50*	*3.20*	3.30	*3.40*	*2.80*	2.98	*3.10*
Eye in Postorbital part of head	*2.10*	2.26	*2.30*	*2 00*	2.05	*2.10*	*1.80*	2.00	*2.20*
Eye in interorbital	*1.00*	1.01	*1.15*	*1.00*	1.02	*1 10*	*0.90*	0.93	*1.00*
Caudal root to ventral insertion in ventral insertion to head	*0.95*	0.99	*1.10*	*0.95*	1.03	*1.10*	*0.85*	1.01	*1.20*

material if equal in the other two sets (i.e., first, third, and fourth). The maximum values of the first and third descend from right to left, whereas the second and fourth show the Chub Cay material to be low, which, expressed another way, indicates a greater variation for the Lake Forsyth specimens. In all cases except the first there is sufficient overlapping to allow the entire matter to be referred to statistical variability. In the first, however, there is a distinct but small break between the maximum from Lake Forsyth and the minimum from the marine localities. More material might easily bridge it. This condition and the other differences indicated in the description, such as the more numerous predorsal scales and the coloration, indicate a definitive difference but one too small to be considered as worthy of full specific rank.

A key to separate these two subspecies may be constructed as follows:

A. Predorsal scales, 80 to 85; eye and postorbital part of head in head, 3.2 to 3.5; dorsal, anal, and caudal touched with brick-red; (West Indies—marine). *S. n. notata* (Poey).

AA. Predorsal scales, 93 to 98; eye and postorbital part of head in head, 2.8 to 3.1; dorsal, anal, and caudal touched with pinkish; (Lake Forsyth—fresh water)....................................*S. n. forsythia,* n. subsp.

Strongylura timucu (Walbaum)

A single specimen of this widely distributed species was taken in the headwaters of Lake Forsyth. Standard length, 290 mm. This fish is *S. timucu* of Breder, 1925, distinct from *S. ardeola* (C. and V.) of Nichols and Breder, 1928, and Breder, 1929, which has been erroneously synonymized with *S. timucu* by Jordan, Evermann, and Clark, 1930.

Chriodorus atherinoides Goode and Bean

Generally common but difficult to seine. Five specimens of from 77 to 105 mm. in standard length.

Caranx latus Agassiz

Abundant. Sometimes at night these could be heard jumping, but at no time was such activity common. Twenty-three specimens of from 92 to 180 mm. in standard length.

Lutianus griseus (Linnæus)

Generally to be found wherever mangrove roots entered the water. For this reason they were not readily seined and could not be taken on a hook because of the persistence of the extremely abundant *Eucinostomus*. Two specimens of 124 and 175 mm. in standard length.

Eucinostomus californiensis (Gill)

The dominant species in Lake Forsyth. Extremely abundant at all collection sites. A large series of several hundred are being held for further study. They range from a few millimeters to about 150 in standard length.

Tetraodon testudineus Linnæus

A single example of 155 mm. in standard length was taken in the headwaters of Lake Forsyth.

Gobiomorus dormitor Lacépède

Two specimens of 87 and 110 mm. in standard length were taken.

Lophogobius androsensis, new species

Type No. 10109, American Museum of Natural History.

Standard length, 38 mm.; total length, 46.5 mm. Head, 3.4; depth, 4.1; dorsal, VI–10; anal, 9; scales, 25. Body robust, slightly compressed; the back elevated; head short, broad; snout short, blunt, 4.4 in head; eye, 3.8 in head; interorbital, 2.1 in eye; mouth oblique, the lower jaw somewhat projecting; maxillary reaching vertical from anterior edge of pupil, 2.6 in head; teeth in jaws in villiform bands, opercle and preopercle unarmed, gill openings restricted to sides, broader than pectoral base, membranes attached to isthmus, forming a fold across it; scales large, ctenoid, absent on head and nape; a fold of skin extending from a vertical over the posterior edge of pupil nearly to end of head but not connected to the dorsal; a space between anterior ray of dorsal and this crest equal to diameter of eye; height of crest equal to pupil; dorsal fins separate, the first one with slender filamentous spines, the median ones longest, the largest spine 2 in head, the second dorsal high but its longest ray (depressed) not reaching to narrowest part of caudal peduncle; caudal fin rounded, the median rays longest, the fin 1.3 in head; ventral fins united forming a sucking disc entirely free from abdomen; pectoral fins large, pointed, the central rays longest,

reaching slightly beyond origin of anal, a little longer than head; anal base two-thirds of dorsal base; anal insertion midway between tip of longest anal ray (depressed) and pectoral axil; ventral fins fall short of anal by the length of the maxillary; dorsal origin behind pectoral insertion.

Color in alcohol pale with three brown lateral stripes, the upper one running from upper margin of orbit to origin of second dorsal. The second from center of eye to upper profile of peduncle, posteriorly breaking into three diffuse spots, the first two under second dorsal and the third on peduncle. The third stripe wider and fainter, extending from pectoral axil to caudal base, breaking into five diffuse blotches posteriorly, the first three slightly in advance of those of the second stripe. Viewed dorsally there are two somewhat broken stripes paralleling the crest of skin. A brown ring on the snout. Spinous dorsal barred with black; soft dorsal, anal and caudal

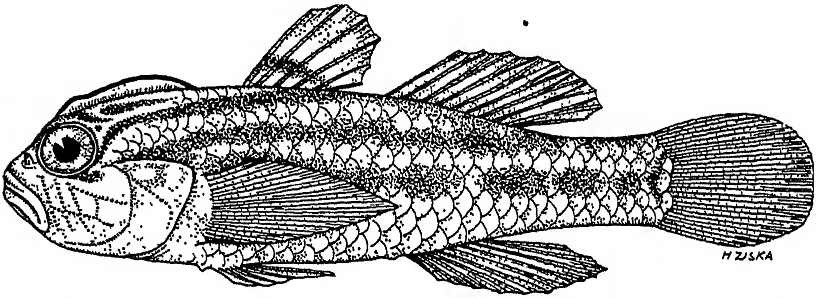


Fig. 3. *Lophogobius androsensis*, new species. Type, 38 mm. standard length.

dusky, slightly darker than ground color of body. Crest with a distinct narrow dark edge for its entire length, a dark line on cheek from lower margin of orbit to pectoral narrower than the rest. Pectorals and ventrals light dusky.

There are three paratypes ranging from 29 to 43[1] mm. standard length.

Named for Andros Island.

This form is distinguished from its two congeners by the smaller and more anterior anal; the shorter soft dorsal; the smaller ventral fins; the disconnection between crest and first dorsal ray; and the pattern.

A key to separate the three forms may be constructed as follows:

A. Anal base about equal to dorsal base; anal insertion midway between tip of longest anal ray (depressed) and pupil; ventral fins reaching beyond anal insertion; dorsal origin over pectoral insertion; longest dorsal ray reaches past base of caudal; crest attached to first dorsal spine; first dorsal without pattern (black or clear).

B.[2] Anal with 11 spines and rays together; snout, 3 to 3.5; color uniformly dark first dorsal black, other fins dusky . . . . *L. cyprinoides* (Pallas).

---

[1]The largest was not selected as type on account of discoloration, due to collecting by means of copper sulphate.

[2]This part of key based on Parr, 1930. Also see Parr's discussion of the status and distribution of *L. cyprinoides* and *pallidus*.

BB. Anal with 9 or 10 spines and rays together; snout, 4 to 4.5; color light, with a pattern of dots, smaller than eye, on body; fins all pale... *L. pallidus* Parr.

AA. Anal base about two-thirds of dorsal base; anal insertion midway between tip of longest anal ray (depressed) and pectoral axil; ventral fins falling far short of anal insertion; dorsal origin behind pectoral insertion; longest dorsal ray reaches not quite to narrowest part of peduncle; crest terminates at end of head, not nearly reaching first dorsal spine; first dorsal mottled or barred; pattern of body, one of three horizontal brown stripes breaking into blotches as large as eye, posteriorly; dorsal mottled with black. *L. androsensis*, n. sp.

The data on these three species may be expressed by the following tabulation showing the similarities as well. The character showing significant differences from *L. cyprinoides* is italicized in each case.

	L. pallidus	*L. cyprinoides*	*L. androsensis*
Head	3.3	3	3.4
Depth	3.8	2.88	4.1
Dorsal	VI–10, to 12	VI–10	VI– 9 or 10
Anal	11	9–10	9–10
Scales	25–27	27	26
Snout	*3–3.5*	4–4.5	4.4
Eye	3.5	3.35	*3.8*
Maxillary	2.6	2.68	2.6
Reach of longest dorsal ray	Past base of caudal	Past base of caudal	*To peduncle*
Interorbital in eye	*3.0*	2+	2.1
Longest caudal rays	*Upper*	Middle	Middle
Reach of crest	Attached to first dorsal ray	Attached to first dorsal ray	*To end of head*
Anal base in dorsal base	1.0	1.0	*1.5*
Anal insertion midway between tip of longest depressed anal ray and	Pupil	Pupil	*Pectoral axil*
Dorsal color	*Pale*	*Black*	*Mottled* or barred
Pattern on body	*Rows of small dots*	*Plain*	*Rows of blotches*
Ventral fins reach to anal insertion	Beyond	Beyond	*Short of*
Dorsal origin	Over pectoral insertion	Over pectoral insertion	*Behind pectoral insertion*

LIST OF REFERENCES

BREDER, C. M., JR. 1925. 'Notes on Fishes from Three Panama Localities.' Zoologica, IV, No. 4, Sept. 18, 1925.

1929. 'Report on Synentognath Habits and Development.' Carnegie Inst. Year Book No. 28, 1928–1929, Dec. 12, 1929.

JORDAN, D. S., EVERMANN, B. W., AND CLARK, H. W. 1930. 'Check List of the Fishes and Fish-like Vertebrates of North and Middle America, North of the Northern Boundary of Venezuela and Colombia.' Appendix X to Report of U. S. Commissioner of Fisheries, 1928, B. F. Doc. 1055, 1930.

NICHOLS, J. T., AND BREDER, C. M., JR. 1928. 'An Annotated List of the Synentognathi with Remarks on Their Development and Relationships.' Zoologica, VIII, No. 7, June 11, 1928.

PARR, A. E. 1930. 'Teleostean Shore and Shallow-water Fishes from the Bahamas and Turks Island.' Bull. Bingham Oceanogr. Coll., III, Art. 1, Peabody Mus. Nat. Hist., Yale, 1930.

AMERICAN MUSEUM NOVITATES

Number 552 | Published by The American Museum of Natural History, New York City | Aug. 17, 1932

56.9,66 (1181:51.7)

CORYPHODONTS AND UINTATHERES FROM THE MONGOLIAN EXPEDITION OF 1930[1]

By Henry Fairfield Osborn and Walter Granger

The 1930 collection of vertebrate fossils from Mongolia, one of the largest of the five years of exploration in the Gobi, is distinguished by the abundance of material of the shovel-tusked Mastodon *Platybelodon* and of three different kinds of amblypods, formerly rare in our Mongolian collections. Of this latter order three distinct groups are represented, two belonging to the family Coryphodontidæ previously known from Mongolia, and one belonging to the Uintatheriidæ, the first known occurrence of this family outside of North America with the exception of *Prodinoceras* from the Gashato Paleocene of the western Gobi.

Of the Coryphodontidæ there are additional specimens of the genus *Eudinoceras*, Osborn, 1924, from the Upper Eocene Irdin Manha beds, and a single specimen, a beautifully preserved skull of a distinctly new genus, *Hypercoryphodon*, Osborn and Granger, 1932, from the mid-Oligocene Houldjin Gravels; this new form is presumably the last representative of the order Amblypoda which was formerly supposed to have become extinct in Upper Eocene times.

The coryphodontids accordingly include:

Eudinoceras: Upper Eocene, Irdin Manha horizon, brachycephalic.
Hypercoryphodon: Mid-Oligocene, Houldjin Gravels, extremely dolichocephalic.

The Uintatheriidæ are represented in the Upper Eocene Irdin Manha formation by the new form *Gobiatherium*, the name signifying "the wild beast of the Gobi" in contrast to its distant American relative, *Uintatherium*, "the wild beast of the Uinta Mountains."

List of Materials

1. From the Houldjin Gravels—Oligocene.

Hypercoryphodon thomsoni, gen. et sp. nov.

A. M. 26384. Complete skull.

2. From the Irdin Manha beds—Upper Eocene

Eudinoceras mongoliensis

A. M. 26611. Lower jaws with nearly complete dentition.

[1]Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 113.

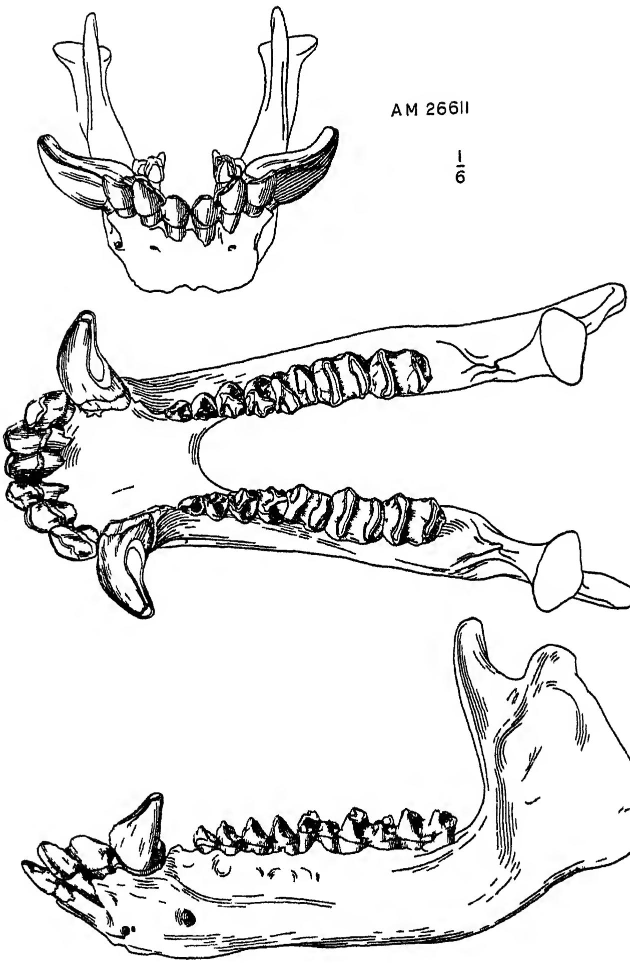


Fig. 1. ?*Eudinoceras mongoliensis*. Anterior, superior and left lateral views of mandible. A. M. 26611, from the Irdin Manha beds (type horizon), Iren Dabasu region. One-sixth natural size.

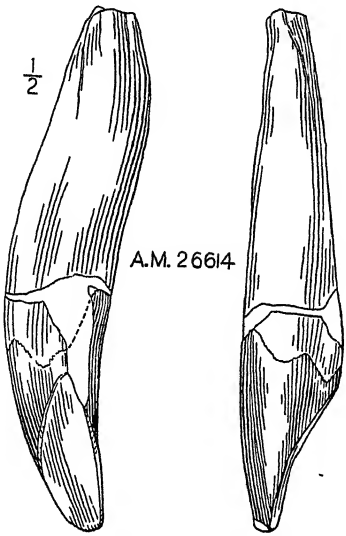


Fig. 2. *?Eudinoceras mongoliensis*. Right upper canine, probably of a female skull. A. M. 26614, from the Irdin Manha beds (type horizon), Iren Dabasu region. Found in association with fragmentary M^3 shown in Figure 3. Inner (left) and anterior (right) aspects. One-half natural size.

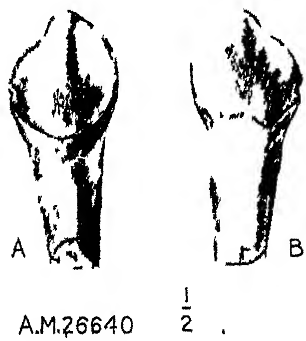


Fig. 3. *?Eudinoceras mongoliensis*. Portion of a last right upper molar. A. M. 26614 from the Irdin Manha beds (type horizon), Iren Dabasu region. Found in association with canine shown in Figure 2. One-half natural size.

Fig. 4. *?Eudinoceras mongoliensis*. Incisor tooth. Lingual (A) and labial (B) aspects. A. M. 26640. Irdin Manha beds (type horizon), Iren Dabasu region. One-half natural size.

List of Materials (Continued)

Eudinoceras mongoliensis (*Continued*)

A. M. 26612. Lower jaw with P_2-M_3.
A. M. 26613. Lower jaw with P_2-M_3.
A. M. 26614. Upper canines, incisor, and fragments of upper molars.
A. M. 26638. P^3.
A. M. 26639. Fragmentary skull with roots of molars and premolars.
A. M. 26640. Incisor tooth.

Gobiatherium mirificum, gen. et sp. nov.

A. M. 26615. Lower jaw fragment with M_{2-3}.
A. M. 26616. Anterior portion of lower jaws with P_2-M_3.
A. M. 26617. Maxilla with P^2-M^3.
A. M. 26618. Front of skull, juvenile, P^2-M^2.
A. M. 26619. Palate and lower jaw—association uncertain.
A. M. 26620. Back of skull with P^4-M^3.
A. M. 26621. Lower jaw with P_3-M_3.
A. M. 26622. Lower jaw, juvenile, with dM_{3-4} and M_1.
A. M. 26623. Right half of skull with P^3-M^3.
A. M. 26624. Nearly perfect skull with P^2-M^3.
A. M. 26625. Nearly complete skull with P^2-M^3.
A. M. 26637. Skull, teeth badly worn or absent.
A. M. 26627. Two incisors and one molar—unassociated.
A. M. 26629. Top of skull—no teeth.
A. M. 26630. Lower jaws with P_2-M_3.
A. M. 26631. Anterior portion of skull with vestigial canine.
A. M. 26632. Lower jaw with P_2-M_3.
A. M. 26633. Lower jaw with P_2-M_3.
A. M. 26634. Naso-frontal region of skull.
A. M. 26635. Lower jaw with M_3.
A. M. 26636. Humerus.
A. M. 26626. Femur.
A. M. 26628. Astragalus, four metapodials and one rib—unassociated.

Family: Coryphodontidæ

Eudinoceras, Osborn, 1924

When first discovered (Osborn, 1924.626, p. 2),[1] *Eudinoceras mongoliensis,* based on two isolated fourth superior premolar teeth (*op. cit.,* p. 4), this animal was regarded as a Mongolian representative of the American genus *Dinoceras.* Subsequent discovery enabled Osborn and Granger[2] to correct this error and place *Eudinoceras mongoliensis* as a relative of *Coryphodon* chiefly distinguished by the rudimentary development of the protocones on the superior premolars in contrast to the large crescentic protocones characteristic of the true genus *Coryphodon.* At the same time two species were characterized, namely:

Eudinoceras mongoliensis (Osborn, 1924), Irdin Manha formation, *Protitanotherium* life zone of the eastern Gobi.

[1]Osborn, H. F., 1924.626. *Eudinoceras,* Upper Eocene Amblypod of Mongolia. Amer. Mus. Novitates, No. 145, Nov. 10, 1924, pp. 1–5, text figs. 1, 2.

[2]Osborn, H. F., and W. Granger, 1931.845. Coryphodonts of Mongolia, *Eudinoceras mongoliensis* Osborn, *E. kholobolchiensis* sp. nov. Amer. Mus. Novitates, No. 459, March 4, 1931, pp. 1–13, text figs. 1–11.

Eudinoceras kholobolchiensis (Osborn and Granger, 1931)[1], Kholobolchi formation, *Eudinoceras kholobolchiensis* life zone of the western Gobi.

GENERIC AND SPECIFIC CHARACTERS.—Cranium (*E. kholobolchiensis*) relatively broad (360 mm.) in relation to its total length (516 mm.); full eutherian dentition above and below. Incisors and canines similar to those in *Coryphodon*; maxillary rostrum broadened. Premolars, four superior and inferior, protocones rudimentary (*E. mongoliensis*), protocones larger (*E. kholobolchiensis*). Superior molars readily distinguished from those of *Coryphodon testis* by progressive lophodonty of the nearly parallel protoloph and metaloph, in wide contrast to the crescentic disposition of the metaloph in all species of *Coryphodon*, e.g., genotypic species *C. eocænus* Owen, or the American species *C. testis*.

The authors concluded: "In brief, the premolars and molars of *Eudinoceras* represent a specific and generic line of evolution independent from that of the American coryphodonts, but, as with the cranium, the premolars indicate that this phylum is much nearer *Coryphodon* than *Uintatherium* (=*Dinoceras*)."[2]

LOWER DENTITION.—From the Irdin Manha beds, about twenty miles west of the type locality of *Eudinoceras mongoliensis* and in the same horizon, the 1930 Expedition obtained the first specimens of lower jaws of this form. Of the three specimens found, two are single rami with cheek teeth present, while the third is a splendid pair of lower jaws (Fig. 1) exhibiting the full dentition. The type of *E. mongoliensis* is an upper premolar, and upper and lower teeth of this form have never been found in association, but there seems little doubt that these three jaws pertain to this genus and presumably to the genotypic species.

There is a remarkable similarity between these lower jaws and those of *Coryphodon*, both in the general outlines of the jaws and in the teeth. The chief differences are that in *Eudinoceras* the lophs of the molars are not connected by a transverse crest, the premolars show more antero-posterior compression and the canines have an unusual outward flare.

HYPERCORYPHODON, gen. nov.

This genus is based upon the new genotypic species *Hypercoryphodon thomsoni* as described below:

Hypercoryphodon thomsoni, sp. nov.

TYPE.—A. M. 26384. A splendidly preserved skull with all cheek teeth and alveoli of incisors and canines.

HORIZON AND LOCALITY.—Houldjin Gravels, mid-Oligocene. Twenty-five miles southwest of Iren Dabasu, Inner Mongolia. Found and collected by Chinese Assistant Chih. Central Asiatic Expedition, 1930.

GENERIC AND SPECIFIC CHARACTERS.—Dentition 3. 1. 4. 3.; full eutherian formula. I^1 the largest of the incisor series, I^{2-3} of equal size and slightly smaller than I^1, canine larger than I^1 but not enlarged as in *Coryphodon* or *Eudinoceras*. The type skull of *Hypercoryphodon* may possibly be that of a female, in which case the canines

[1]Osborn and Granger, 1931, *op. cit.*, p. 4, fig. 2.
[2]Idem, p. 7.

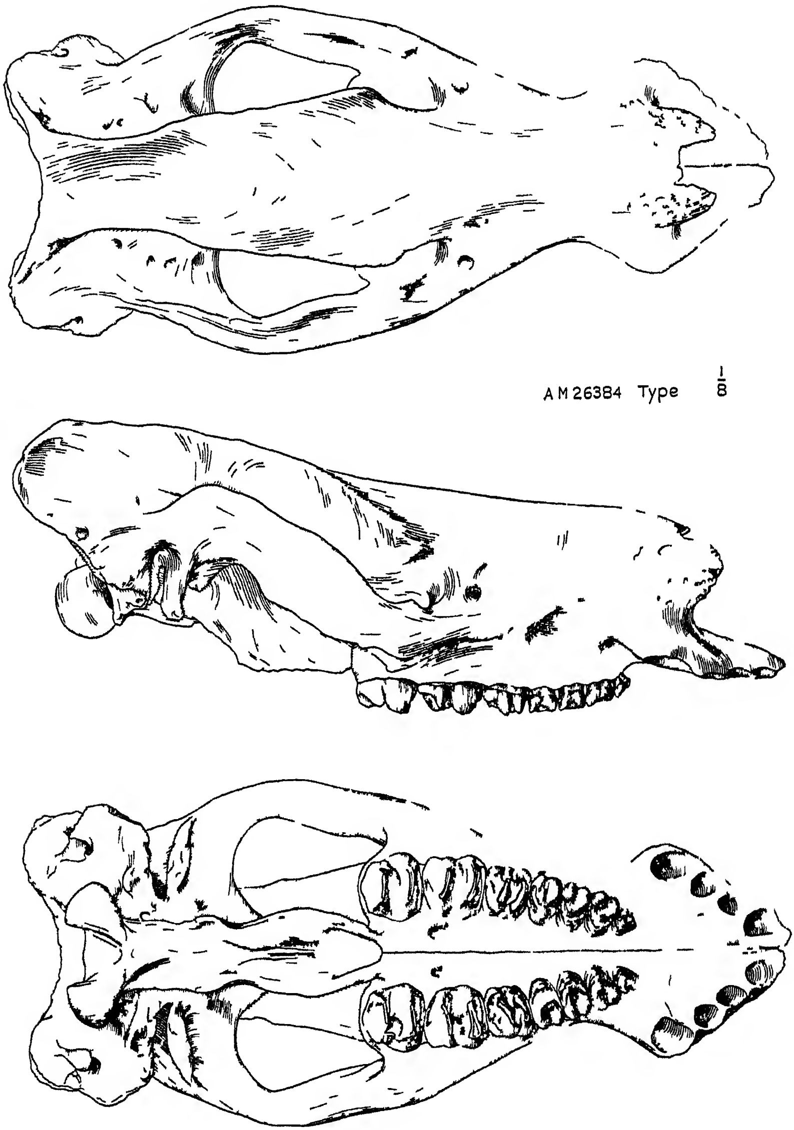


Fig. 5. *Hypercoryphodon thomsoni*, gen. et sp. nov. Type, A. M. 26384. Superior, right lateral and palatal views of skull. One-eighth natural size.

would naturally be much reduced. Cheek teeth of general coryphodont type. Premolars with outer crests much more flattened and less V-shaped than in *Eudinoceras*, in which respect they approach more nearly *Coryphodon*. Premolar protocones strongly developed and more crescentic than in *Eudinoceras*. A strong inner cingulum on P_2-P_4. P^1 about half the transverse diameter of P^2. P^{2-4} subequal in size, increasing slightly in size toward the molars. Molars quadrate with anterior and posterior crests parallel to each other, the anterior crest being somewhat the longer. Crests on M^3 transverse, those on M^{1-2} directed backward toward the median line. On the outer face of the molars there is a strong median rounded cusp which is connected with the posterior crest. Cingulum on inner border of M^1 broken, on M^2 continuous but weak, absent on M^3. M^1 smallest of the series, M^{2-3} about equal in size.

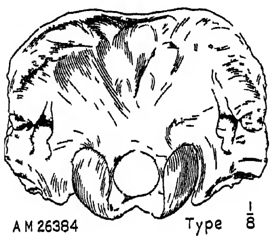


Fig. 6. *Hypercoryphodon thomsoni*, gen. et sp. nov. Type, A. M. 26384. Occipital view of skull. One-eighth natural size.

Skull much elongated, in which respect it differs from any other known coryphodont. The sagittal crest very moderately flattened and broadened. Top of skull without swellings or horn bosses; the median profile, from the lambdoidal ridge to the nasal, is nearly straight. Maxillo-premaxillary region moderately expanded.

Supplementing the above summary of generic and specific characters are the rugosities on either face of the superior maxilla, indicating either a cartilaginous exostosis or the attachment of muscles for a large flexible upper lip. The highly distinctive character of the cranium is its elongation (800 mm.) or dolichocephaly, affording a length, breadth and cranial index of 45 in contrast to the length, breadth and cranial index of 70 in *Eudinoceras kholobolchiensis*. The second highly distinctive feature is the extreme *lophodonty* or perfection of the transverse crests of the superior molars, comparable to that attained in all hyper-lophodont ungulates, and widely dissimilar to the lopho-selenodont molars of *Coryphodon*; this is a progressive stage beyond the lophodonty of *Eudinoceras*. A double, clear distinction from *Eudinoceras* is afforded both by the extreme dolichocephaly and by the bicrescentic structure of the premolar teeth which surprisingly resemble those of *Coryphodon testis*.

Measurements of *Hypercoryphodon thomsoni*, Type

Greatest length, premaxillæ to lambdoidal ridge	800 mm.
Greatest width across middle of arches.. ...	362
Width across lambdoidal ridge on level with condyle. .	310
Width across postorbital processes. . .	190
Width of crest at narrowest point (posterior).	. 95
Width across canine alveoli. . . .	225

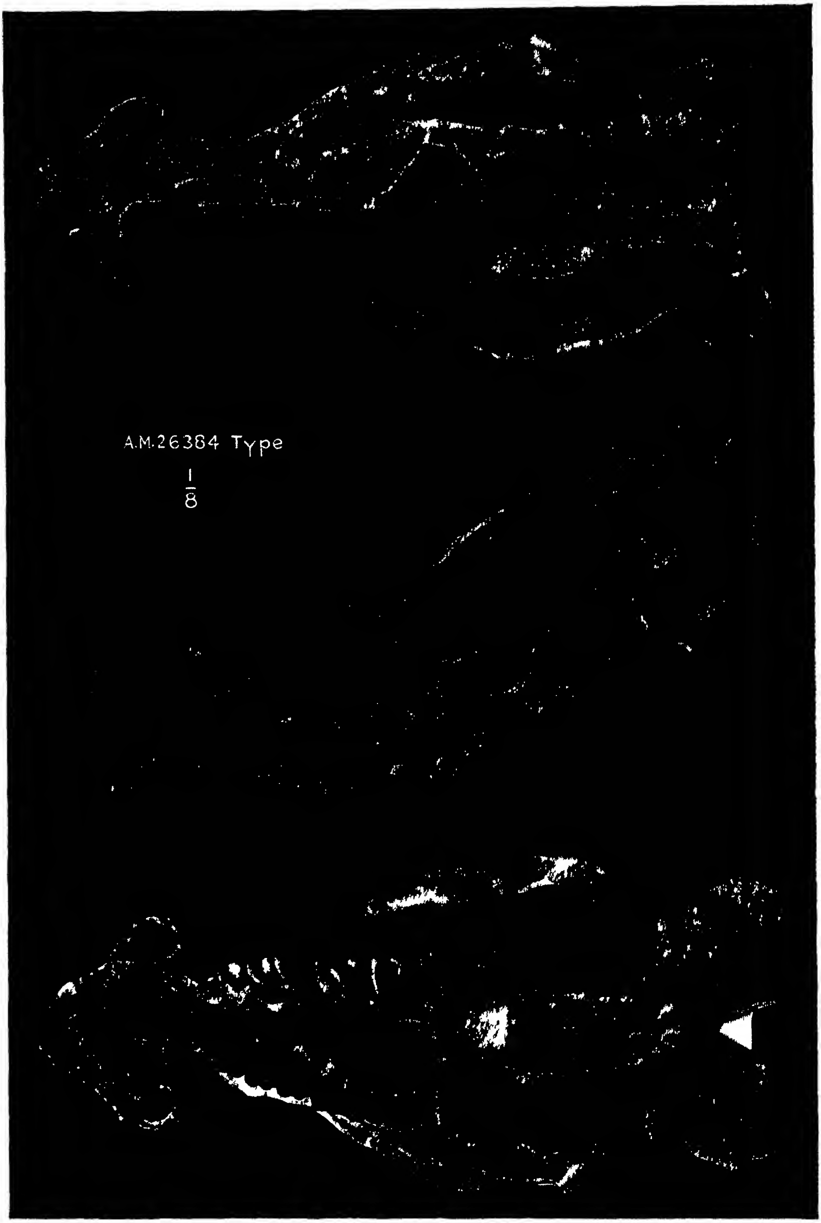


Fig. 7. *Hypercoryphodon thomsoni*, gen. et sp. nov. Type, A. M. 26384. Superior left lateral and palatal views of skull. One-eighth natural size.

MEASUREMENTS OF *Hypercoryphodon thomsoni*, TYPE (Continued)

Depth of skull at M^2	250 mm.
P^1-M^3	311
P^1-P^4	128
M^1-M^3	183
P^1 ant.-post.	25.5
P^1 transverse	28
P^2 ant.-post.	32
P^2 transverse	51.2
P^4 ant.-post.	32
P^4 transverse	58
M^1 ant.-post.	52
M^1 transverse	62
M^2 ant.-post.	65
M^2 transverse	73 (estimated)
M^3 ant.-post.	64.5
M^3 transverse	76
Canine alveolus (diagonal)	45

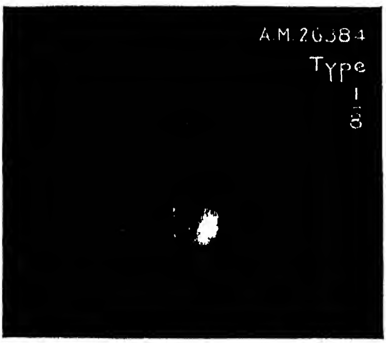


Fig. 8. *Hypercoryphodon thomsoni*, gen. et sp. nov. Type, A. M. 26384. Occipital view of skull. One-eighth natural size.

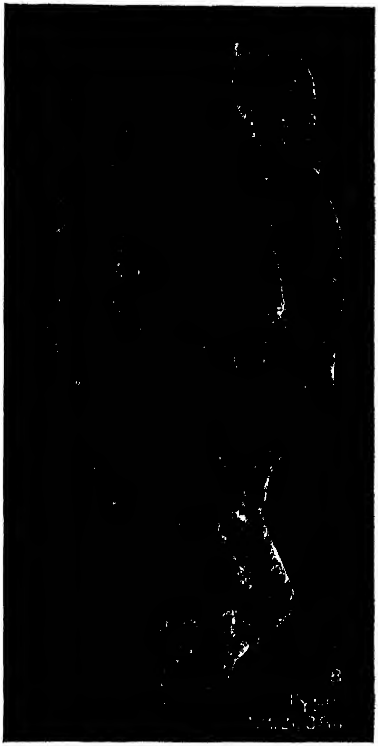


Fig. 9. *Hypercoryphodon thomsoni*, gen. et sp. nov. Type, A. M. 26384. Anterior-oblique view of top of skull. One-eighth natural size.

Family: **Uintatheriidæ**

Gobiatherium, gen. nov.

This new genus is based upon the genotypic species, *Gobiatherium mirificum*, names indicating that it may be considered one of the most outstanding of the many surprising discoveries of the Central Asiatic Expeditions.

Gobiatherium mirificum, sp. nov.

Type.—A. M. 26624, a complete and nearly perfect skull.

Paratype.—A. M. 26630, a nearly complete pair of lower jaws, lacking the incisors.

Horizon and Locality.—From the Upper Eocene Irdin Manha formation. Twenty-five miles southwest from Iren Dabasu, Inner Mongolia. Found by Dr. H. C. Chang.

Generic and Specific Characters.—Dentition $\frac{0}{3}\cdot\frac{0}{1}\cdot\frac{3}{3}\cdot\frac{3}{3}$. Molars and premolars similar to those of *Dinoceras*. Lower incisors bilobed. Lower canines probably like the incisors. Skull elongate and rather low and entirely lacking in the median and posterior horns of the American uintatheres. Sagittal region broad and flat except for a slight swelling extending across the skull about half-way between the orbits and the occiput. Zygomatic arches very broad, flaring out abruptly in the region of the glenoid facet. Nasal region either highly arched medially or divided into small upturned paired horns, probably a sex differentiation. In the two specimens with arched nasals, presumed to be males, there is a curved median bony septum connecting the nasals with the tips of the premaxillæ, and in one of these, see Fig. 11, the nasals are surmounted by a pair of bony excrescences. Lower jaw broadly spatulate in the symphyseal region and shallow and slender in the shaft, ascending ramus higher than in *Dinoceras*, no suggestion of the flange which is observed in American uintatheres and is correlated with an enlarged flattened upper canine. Humerus and femur similar in structure and proportions to *Dinoceras* but metapodials more elongate and slender.

Measurements of Type Skull of *Gobiatherium mirificum*, A. M. 26624

Greatest length, premaxillæ to condyles	680 mm.
Greatest width, across zygomatic arch	400
Depth of skull in nasal region	170
Depth of skull above P^2	80
Width of top of skull at postorbital constriction	135
P^2-M^3	153
P^2-P^4	62
M^1-M^3	91
P^2 ant.-post.	20
P^2 transverse	20
P^3 ant.-post.	20
P^3 transverse	25
P^4 ant.-post.	21
P^4 transverse	27

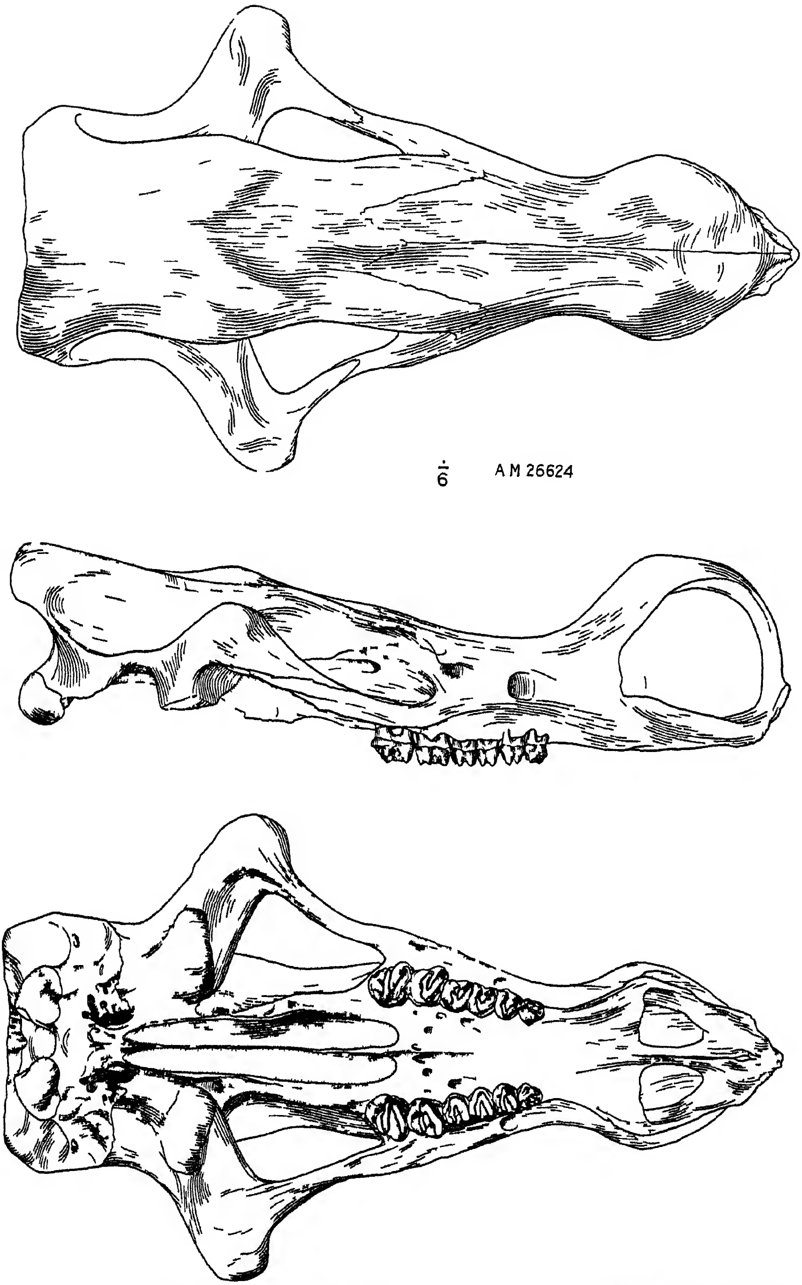


Fig. 10. *Gobiatherium mirificum,* gen. et sp. nov. Type, A. M. 26624. Superior, right lateral and palatal views of skull. One-sixth natural size.

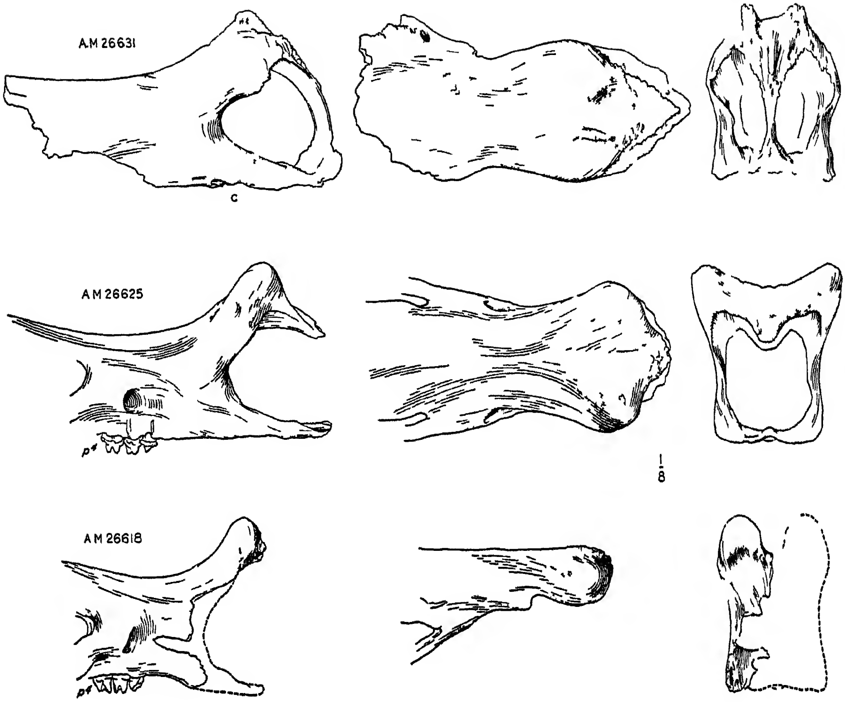


Fig. 11. *Gobiatherium mirificum*, gen. et sp. nov. Anterior portions of three skulls; side, top and front views to show variation in the structure of the nasals. The two uppermost (A. M. 26631 and A. M. 26625) are adults; the bottom one (A. M. 26618) is young with the M^3 unerupted. Note the vestigial canine in the side view of A. M. 26631. One-eighth natural size.

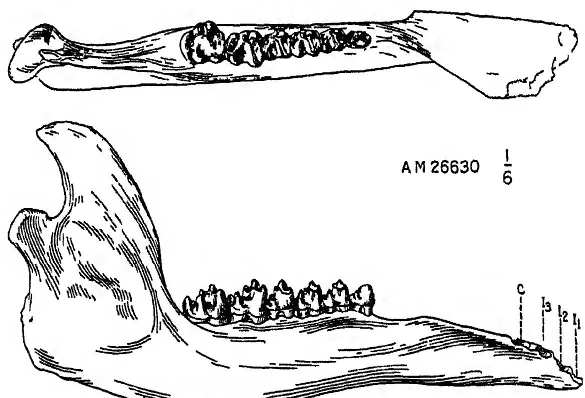


Fig. 12. *Gobiatherium mirificum*, gen. et sp. nov. Right ramus of the lower jaws. External and crown views. A. M. 26630. One-sixth natural size. The anterior alveolar border is restored from the left side.

MEASUREMENTS OF TYPE SKULL OF *Gobiatherium mirificum*, A. M. 26624 (Continued)

M^1 ant.-post.	23 mm.
M^1 transverse	25
M^2 ant.-post.	30
M^2 transverse	30
M^3 ant.-post.	35
M^3 transverse	32

MEASUREMENTS OF PARATYPE LOWER JAW OF *Gobiatherium mirificum*, A. M. 26630

Greatest length	480 mm.
Depth of ramus at M_1	67
P_2-M_3	163
P_2 ant.-post.	20
P_2 transverse	12
P_3 ant.-post.	23
P_3 transverse	18
P_4 ant.-post.	23
P_4 transverse	21
M_1 ant.-post.	28
M_1 transverse	23
M_2 ant.-post.	31
M_2 transverse	29
M_3 ant.-post.	39
M_3 transverse	36

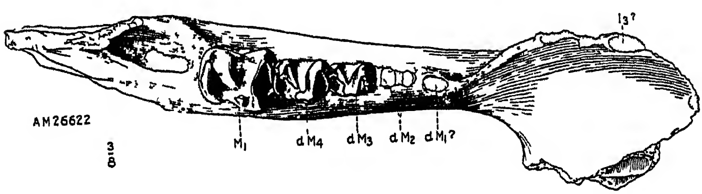


Fig. 13. *Gobiatherium mirificum*, gen. et sp. nov. Left ramus of lower jaw, crown view. Young individual with third and fourth milk molars and first true molar. A. M. 26622. Three-eighths natural size.

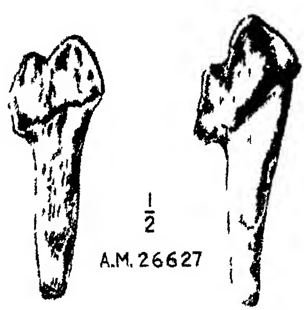


Fig. 14. *Gobiatherium mirificum*, gen. et sp. nov. Two left lower incisor teeth, lingual views. A. M. 26627 (association uncertain). One-half natural size. These teeth were found loose in the deposit which yielded several skulls and jaws of this species.

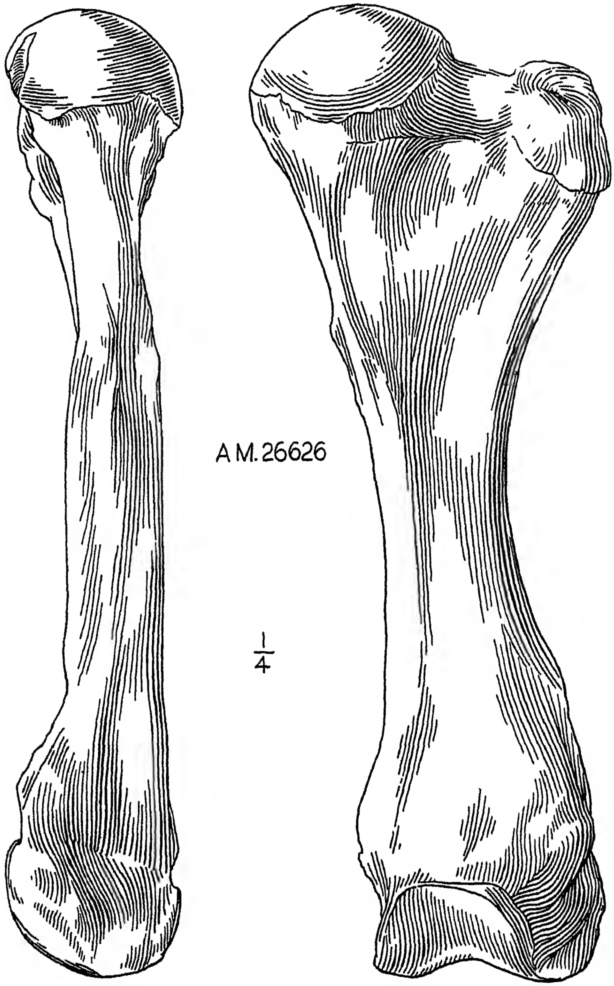
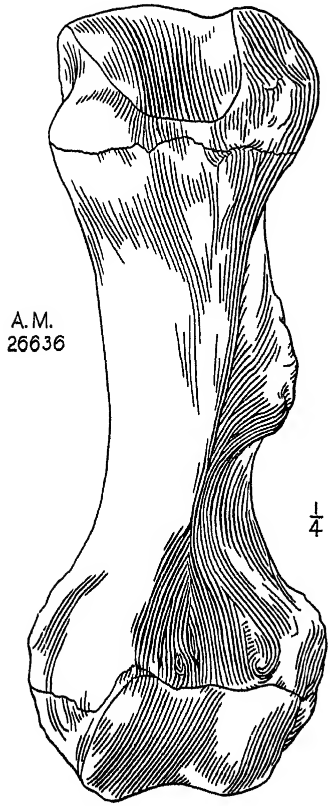


Fig. 15. *Gobiatherium mirificum*, gen. et sp. nov. Left femur, anterior and inner views. A. M. 26626. One-fourth natural size.

As shown in the superb genotypic cranium, this new genus from the Old World conserves the microdont, triangular, and fundamentally tritubercular superior and inferior dentition characteristic of the American uintatheres, including both *Dinoceras* and *Loxolophodon.* This



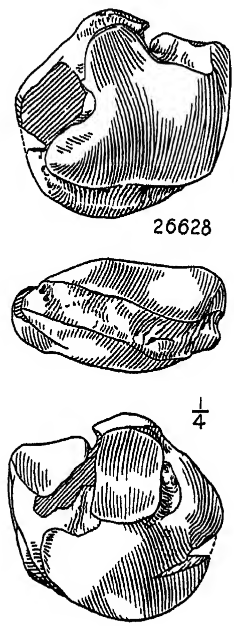


Fig. 16. *Gobiatherium mirificum,* gen. et sp. nov. Left humerus, anterior view. A. M. 26636. One-fourth natural size.

Fig. 17. *Gobiatherium mirificum,* gen. et sp. nov. Left astragalus, proximal, anterior and distal views. A. M. 26628. One-fourth natural size.

dentition leaves us in no doubt that this type should be embraced within the family Uintatheriidæ. On the other hand, if the dentition were unknown, there are few, if any, characters of the cranium suggestive of relationship either to *Dinoceras* or *Loxolophodon,* excepting perhaps the extreme dolichocephaly indicated in the equally elongate cranial and

facial moieties. Two characters are surprising: the wide transverse extension of the zygomatic arches, reminding us of similar prominences in *Entelodon*, and the relatively low, flat, backwardly extended temporal fossa and occiput doubtless correlated with the feeble development of the muscles of mastication in adaptation to the relatively long and slender mandible. The absence of the downward flange in the slender anterior rostrum of the mandible may possibly be a sexual character, because in the female uintatheres with small tusks, the mandibular flange is much less prominent than in the males with their great tusks. However, in the seven specimens present there is no trace of a flange.

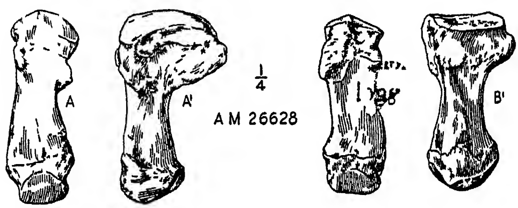


Fig. 18. *Gobiatherium mirificum*, gen. et sp. nov. A and A′—third metacarpal of the left foot, anterior and ulnar views. B and B′—second metacarpal of the right foot, anterior and radial views. A. M. 26628. One-fourth natural size.

Of all distinctive features, however, the extremely elevated and arched nasals, rising above the level of the cranial vertex and supported by a median fully ossified septum resting on the slender premaxillaries, are not only surprising but unique.

Similar to the typical Uintatheriidæ is the edentulous premaxillary, and in great contrast is the absence of canines, with the exception of one specimen which exhibits an extremely vestigial canine on one side only.

AMERICAN MUSEUM NOVITATES

Number 553 | Published by The American Museum of Natural History New York City | August 22, 1932

56.7 (51.7)

THE FOSSIL FISHES COLLECTED BY THE CENTRAL ASIATIC EXPEDITIONS[1]

By L. Hussakof

INTRODUCTION

Among the palæontological materials collected by the Central Asiatic Expeditions of The American Museum of Natural History, there is an interesting small collection of fossil fish remains. Like the other palæontological specimens of these expeditions, the fishes were collected in the Gobi desert, Mongolia, and are from several different formations.

At the suggestion of Dr. Walter Granger, of The American Museum of Natural History, Chief Palæontologist of the Central Asiatic Expeditions, I have made a study of these specimens, and present the results in this paper. My thanks are due to Dr. Granger for transcripts from his field notes of data on the localities and formations from which the specimens were obtained.

The materials covered by this paper include the fossil fishes collected by all the field expeditions, from 1922 to 1930. Only the few specimens of *Lycoptera* figured by Cockerell in 1925 (3) were not available for this study; however, the clear illustrations from photographs, in his paper, made it possible to take those specimens also into account in the study of that species.

Berkey and Morris' volume, "Geology of Mongolia" (1), afforded helpful information on the geology, and showed which formations are of freshwater origin.

SUMMARY OF THE SPECIMENS AND THEIR GEOLOGIC OCCURRENCE

The groups of fossil fishes collected by the Central Asiatic Expeditions, and the special points regarding them discussed in this paper, may be summarized as follows:

1. Specimens of a small, primitive teleostean, genus *Lycoptera*, from the Lower Cretaceous (Ondai Sair formation).

---

[1]Publications of the Asiatic Expeditions of The American Museum of Natural History. Contribution No. 114.

This little fish is of considerable theoretic interest because of Professor Cockerell's suggestion (3) that this family, the Lycopteridæ, probably represents the ancestral forms of the Cyprinidæ. This view is briefly examined in connection with the description of the species, which I find to be new.

2. Many detached bones and vertebræ from the Eocene formations. These specimens constitute the bulk of the Mongolian fish collection.

The majority of these remains represent a large amioid fish, 5 or 6 feet in length, of the genus *Pappichthys*. This genus was heretofore known by four species, all from the Eocene (Bridger beds) of Wyoming, and represented by mere fragments, jaw elements and vertebræ.

The Mongolian species is distinct from the American; and the material in the collection acquaints us with a number of skeletal elements of *Pappichthys* not found before.

With these amioid remains were collected a few opercular bones referable to the existing teleostean genus *Catostomus* (or a genus very close to it), and a few small vertebræ of catostomids or Cyprinidæ.

3. Pectoral spines of a catfish, a new species of the genus *Rhineastes*, from the Pliocene (Tung Gur beds).

The species represented in the collection, and their geologic horizons, are shown in the following table.

The Gobi Formations In Which Fishes Were Found by the Asiatic Expeditions and the Species from Each

Period	Formation	Fishes
Pliocene	Tung Gur	*Rhineastes grangeri*, n. sp.
Eocene	Shara Murun[1]	*Pappichthys mongoliensis*, n. sp. *Catostomus* sp. Cyprinid vertebræ
	Tukhum	(No fishes found)
	=Ulan Shireh	*Pappichthys mongoliensis*
	=Irdin Manha	*Pappichthys ? mongoliensis* n. sp.
Cretaceous	Ondai Sair (Paper-shale)	*Lycoptera fragilis*, n. sp.

[1]In an oral communication, Dr. Walter Granger states that the Shara Murun rests directly upon the Tukhum and therefore is of somewhat later age. The Tukhum, Ulan Shireh and Irdin Manha are equivalent horizons at three different localities.

DESCRIPTION OF SPECIES

LYCOPTERIDÆ

There are several specimens in the collection, of an interesting little fish of the genus *Lycoptera*, from the Ondai Sair paper-shale formation. These paper-shales contain fossil insect larvæ, and other invertebrates belonging to freshwater groups, and hence it is evident the *Lycoptera* found with them was a freshwater fish. The age of the formation, as determined by Cockerell (2) from a study of the biota, appears to be Lower Cretaceous.

The specimens I had for study were all incomplete fishes. But by matching three specimens, each supplying parts missing in the others, I was able to make out the entire form of the fish, and to draw an outline restoration of it (Fig. 6).

The genus *Lycoptera* was established as long ago as 1847, by Johannes Müller, for specimens from eastern Siberia. It was formerly included among the Leptolepidæ (Woodward, 12), but was separated by Cockerell as a distinct family (2).

Cockerell, in a paper on the affinities of *Lycoptera* (3), regarded the Mongolian fish as identical with Müller's Siberian species—*L. middendorffi*. However, the following facts indicate that the Mongolian fish is a distinct species.

In the original description of the species, Johannes Müller states that the dorsal begins a little *behind* the origin of the anal; and his lithograph figure of the type specimen confirms this statement (9, Pl. XI, fig. 1). This, then, defines the position of the dorsal and anal relative to each other in *middendorffi*.

Others who examined specimens from the Siberian formation also state that the dorsal begins a little behind the origin of the anal—Eichwald (5), Woodward (12), Reis (11).[1]

In the Mongolian species, on the other hand, about three-fifths of the dorsal is in *advance* of the anal. And there are other differences from the Siberian fish, as in the shape of the head and the number of fin-rays in the unpaired fins. By present ichthyologic standards, these differences mark the Mongolian fish as a distinct species; and I therefore describe it here as new.

[1]Reis says: "Die Dorsalis steht gegenüber, mit ihren Vorderrand aber etwas hinter dem der Analis." This agrees with Johannes Müller's description. But in his enlarged restoration the position of these fins is not so represented. If his figure is correctly drawn, then a second species was present in his material in addition to *L. middendorffi*.

Lycoptera fragilis, new species

Figures 1–6

COTYPES.—Three incomplete fishes, on small pieces of brown paper-shale: (1) Impression of the front half of a little fish as far as the ventrals (Fig. 1). (2) A fish lacking the head and caudal but showing the pectoral, ventral, dorsal and anal (Fig. 3). (3) Caudal fin (Fig. 2). All are in the American Museum of Natural History.

FORMATION AND LOCALITY.—Ondai Sair paper-shales (Lower Cretaceous); Uskuk, Mongolia. R. W. Chaney, 1923.

A fish about 10 cm. in total length (including caudal). Head longer than the depth, about 3⅝ in length to base of caudal. Head, in lateral view, pointed; mouth small; lower jaw projecting slightly beyond upper. Maxilla apparently reaching beyond eye.

Dorsal 11, anal 13. Dorsal in advance of anal by about three-fifths of its base; its origin a little behind vertical through end of ventral fin when adpressed to body. One or two short, delicate fulcra in front of first dorsal ray; the third or fourth ray of dorsal the highest. Anal a trifle larger than dorsal.

Pectorals relatively large, attached immediately behind cleithrum, and extending two-thirds of distance from their origin to the commencement of the ventrals. Ventrals small, placed about midway between end of pectorals and origin of anal.

Caudal deeply forked, with a few slender, imbricated fulcra at origin of upper lobe.

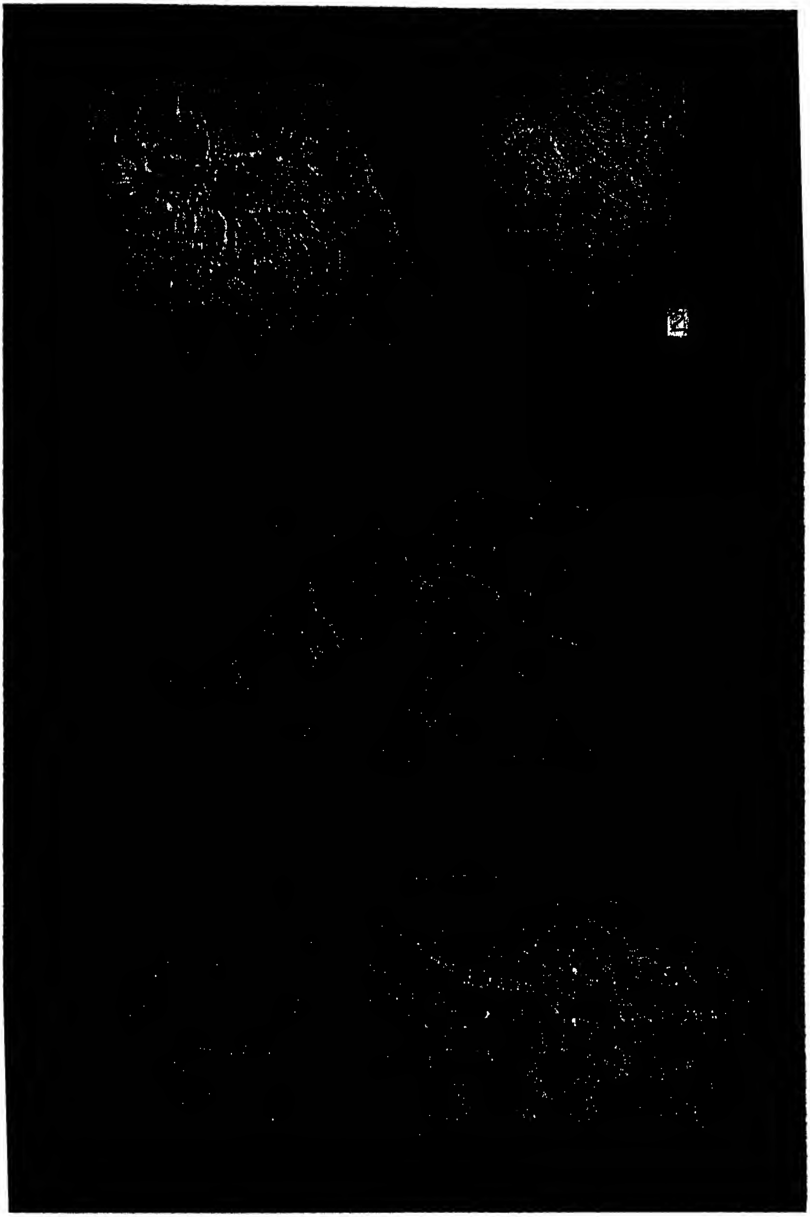
Cotypes (1) and (2) show impressions of delicate, arched ribs, which are more slender than those shown in Woodward's restoration of *L. sinensis* (12, fig. 1).

Three other species of the genus *Lycoptera* are known: *L. middendorffi* Müller, from eastern Siberia (Upper Jurassic); *L. sinensis* Woodward, and *L. ferox* Grabau, from the Province of Shantung, China (Cretaceous). These little fishes resemble one another in size and general form, and it requires close examination to determine which species one has in hand.

The points in which *L. fragilis* differs from *L. middendorffi* have already been noted. From *L. sinensis* and *L. ferox*, it is distinguished especially by the shape of the head: in *fragilis* the head is pointed, with the lower jaw projecting a little beyond the upper, whereas in these two species the snout is rounded, elevated, and projects beyond the lower jaw. There are also other differences, as in the number of fin-rays, the relative size of the pectoral, etc.

THE AFFINITIES OF THE LYCOPTERIDÆ

Cockerell, in a paper discussing the affinities of *Lycoptera* (3), made the interesting suggestion that these little fishes are probably the ancestral forms of the Cyprinidæ. His main reason for this view is the close resemblance in the surface sculpturing of the small, cycloid scales of *Lycoptera* to those of some existing genera of Cyprinidæ, especially the European minnow, *Phoxinus phoxinus*. In addition, the Lycopteridæ are freshwater fishes like the vast majority of existing cyprinids.



Figs. 1–5. *Lycoptera fragilis*, n. sp. Figs. 1, 2, 3, the cotypes. Natural size.

The question of how far the fine markings on fish scales may be considered a criterion of relationship has never been critically examined. Professor Cockerell, in numerous papers on fish scales, has described and illustrated the minute scale markings in many families and a great many genera. These studies have demonstrated that in certain families of fishes a marked similarity in scale sculpturing runs through the different genera, so that in such cases isolated scales may be confidently assigned to their respective families by the scale markings alone.

But Professor Cockerell's studies have also brought to light instances where families which are phylogenetically widely separated show a remarkable similarity in scale markings. For example, in his paper on *Lycoptera* (3), he describes the scales of *Leptolepis dubius* of the Upper Jurassic, and says:

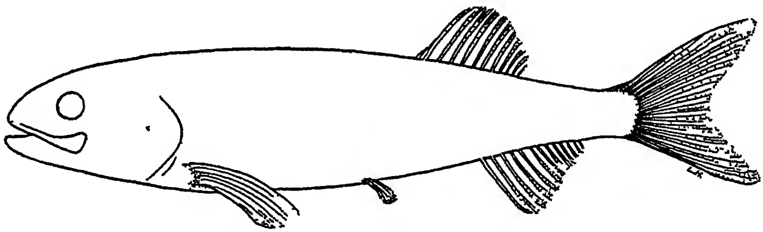


Fig. 6. *Lycoptera fragilis*, n. sp. Outline restoration, natural size.

"Now it is singular that the features of this scale, even to the interference of the circuli laterally and the indication of ridges from the nucleus to the laterobasal corners, are very nearly those of the living *Caranx hippos*." (3, p. 315).

Here, then, we have two forms, the one a primitive isospondyl, the other a carangid, quite remote from each other in relationship, and yet, if we took scale-sculpturing as the criterion of affinity, we should have to consider them related families. This case shows clearly that resemblance in superficial scale detail is not a reliable criterion of phylogenetic relationship. In some cases the resemblance seems to be the result of parallelism.

We cannot therefore accept the resemblance in scale markings of *Lycoptera* and some Cyprinidæ as decisive evidence of affinity between the two groups.

But there are several other points in which *Lycoptera* approaches the Cyprinidæ: (1) The presence of cycloid scales. (2) The arrangement and structure of the fins. (3) Freshwater habitat.

Furthermore, Regan (10) concluded from a systematic review of the cyprinid fishes of the world, that the group probably originated in Asia. Hence we expect to find the fossil ancestors of the Cyprinidæ somewhere in those geological horizons at which the Lycopteridæ actually occur.

These facts lend support to Professor Cockerell's view that the Lycopteridæ are probably the ancestors of the Cyprinidæ. However, it must be borne in mind that the structures of the skull and of the pectoral girdle of *Lycoptera* are still unknown, and have not been compared with those of the Cyprinidæ.

Reis figured the opercular elements of *Lycoptera*, but their form is not distinctive enough to throw any light on the question of affinity. He also figured a gular plate in *Lycoptera*. Although such an element has not been demonstrated in any existing genus of the Cyprinidæ, yet its presence in *Lycoptera* would not militate against the suggested relationship, for we rather expect to find a gular plate in an ancient fish closely allied to the Leptolepidæ.

To sum up: Several facts point to the Lycopteridæ as probably the group from which the Cyprinidæ arose. But definite solution of the question must wait until the structure of the skull and pectoral girdle of *Lycoptera* becomes available for comparison with those of the more generalized existing cyprinids.

AMIIDÆ

Genus **Pappichthys** Cope

The majority of the fossil fishes collected by the Central Asiatic Expeditions are isolated bones and vertebræ from the Gobi Eocene formations. They represent an amioid fish, genus *Pappichthys*, much larger than the surviving amioid the bowfin (*Amiatus calvus*),[1] being five or six feet in length.

The genus *Pappichthys* was established by Cope on jaw elements and vertebræ from the Eocene (Bridger beds) of Wyoming. He described four species (4). A few fragments have also been found in the Upper Cretaceous of Montana and of Saskatchewan, and in the Paleocene of Alberta, as noted in Hay's Bibliography (7).

Since *Pappichthys* is known at present only from detached bones, its exact distinction from *Amiatus* cannot be indicated. But I have

[1]The name *Amia*, by which the existing amioid is commonly known, was first applied to a genus of living teleosts, for which it is in use at the present time. Hence this name cannot be retained for the amioid. Rafinesque wrote the name of the amioid, *Amiatus* (Jordan, 8), and some ichthyologists have begun using this name as the earliest synonym. In the present paper, I likewise use *Amiatus*.

found points of difference in nearly every bone available for comparison, and it appears that *Pappichthys* is a valid genus, not merely a group of large-sized, extinct species of *Amiatus*.

Cope stated that *Pappichthys* differs from *Amiatus* in having "only one series of teeth instead of several, on the bones of the mouth." (4) But this opinion was based on an error in comparison. It is evident that he had compared a mandible of *Pappichthys*, from which, as is generally the case, the delicate splenial bone with its small teeth had been lost, leaving only the row of large teeth on the dentary, with a complete *Amiatus* mandible retaining the splenial teeth. Hence the seeming difference in dentition.

In the Mongolian mandibles of *Pappichthys* at hand, the splenial is also lacking; and I find it is also frequently lost in skeletal material of *Amiatus*.

A direct comparison of a *Pappichthys* mandible with one of *Amiatus* without the splenial, shows a complete agreement in tooth arrangement. In both genera there is a single row of large, slender-conical teeth on the dentary, occupying the front two-thirds of the upper margin of the mandible.

The Mongolian material of *Pappichthys* consists of several groups of bones and vertebræ collected at different localities. Each group includes remains of more than one fish. I have selected from one of the groups several representative elements to serve as the cotypes of the Mongolian species, limiting the cotypes to elements which almost certainly belong to the same species.

Pappichthys mongoliensis, n. sp.

Figures 7–24

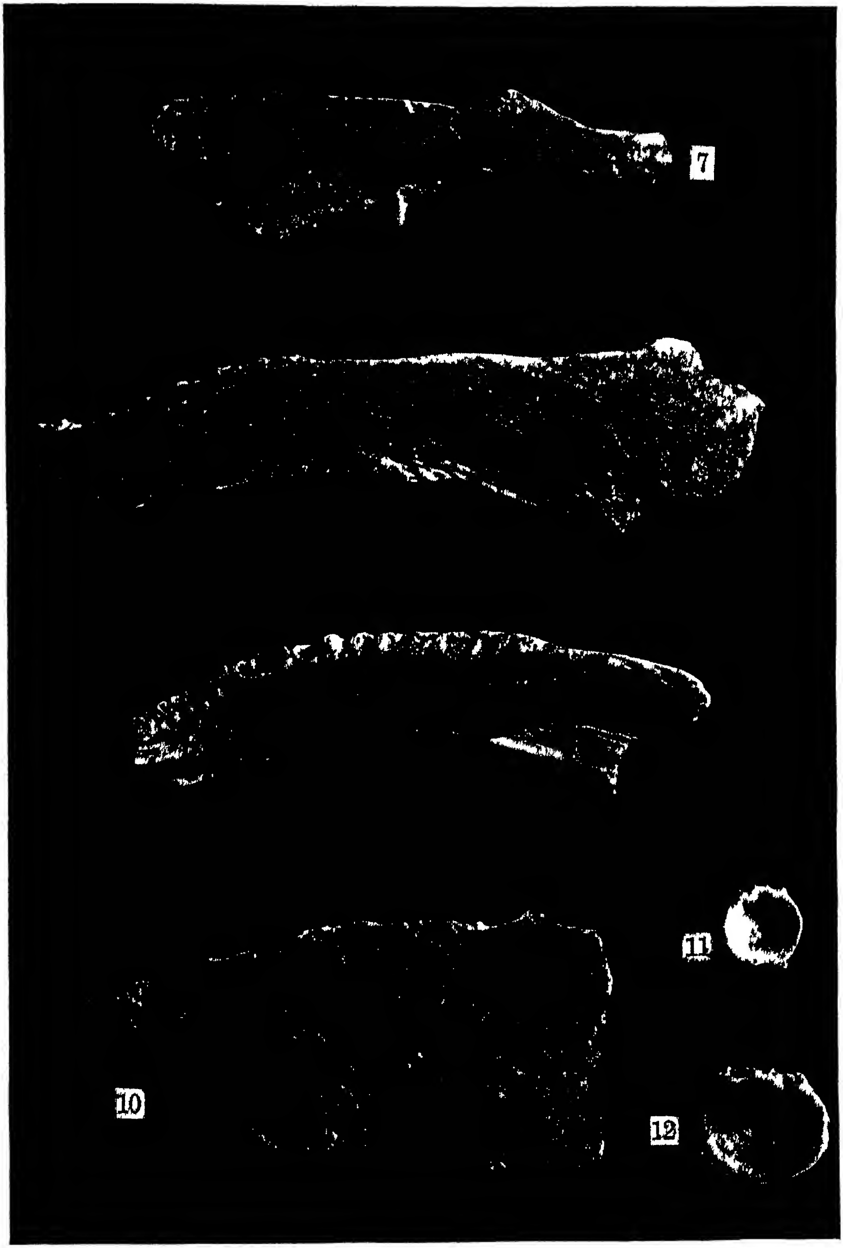
COTYPES.—The specimens shown in Figs 7–12—namely, a right and a left mandible of about the same size; a right maxilla; a gular plate; two vertebræ. They were all collected together but obviously belong to more than one fish. In the American Museum of Natural History.

FORMATION AND LOCALITY.—Eocene (Ulan Shireh beds); North Mesa, Shara Murun region, Inner Mongolia. Field No. 635; "Chimney Butte" Quarry, 1928.

The principal land animals in this formation are titanotheres and chalicotheres.

An amioid fish about 5 feet in length, known by detached bones and vertebræ. The mandible (Figs. 8, 9; 13B) is twice as large as that of the existing *Amiatus calvus*, and relatively much less deep in its posterior half, in outer view. The dentigerous area occupies two-thirds of the upper margin of the dentary, and there are alveoli of 19 teeth. Back of the teeth, the upper margin of the dentary is rounded and smooth.

The maxilla (Fig. 7) is of the same form as in *Amiatus*, but twice as large. The teeth are slender-conical, similar in form to those of the living genus, but much larger; some have the points flexed inward.



Figs. 7–12. *Pappichthys mongoliensis*, n. sp. Cotypes. About natural size.

7. Right maxilla, outer view. 8. Left mandible, incomplete at posterior end; outer view 9. Right mandible, incomplete; inner view. 10. Gular plate, outer view. 11. Caudal vertebra from a small fish. 12. Abdominal vertebra.

The gular plate is shown in Fig. 10. This is the first time this element of *Pappichthys* has been found. The specimen is of about a size to go with the cotype mandibles. The bone is very thin, and at the anterior extremity, in the median line, there is a low, rounded ridge, as in *Amiatus*, strengthening the bone at the point of attachment to the mandibular symphysis. The ridge narrows backward, and disappears beyond the first fourth of the length of the plate.

Vertebræ of the typical amioid form; that is, very short in antero-posterior diameter, and the vertebræ of the abdominal region much wider than high.

Measurements of the abdominal vertebra shown in Fig. 12: Width, 19 mm.; height, 14.5; thickness (i.e., antero-posterior length), 6.5. Vertebra in Fig. 11: Width, 11.5 mm.; height, 10; thickness, 4.5.

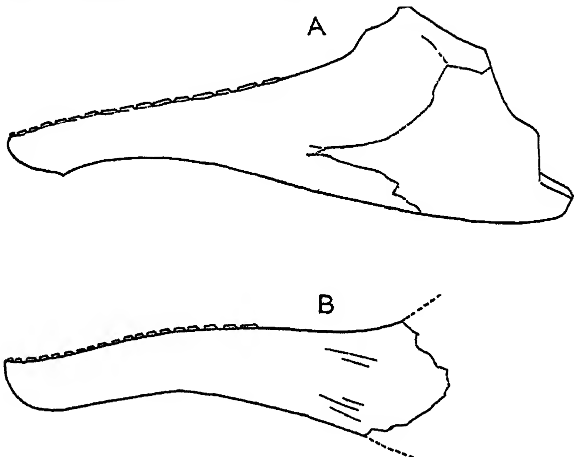


Fig. 13. Mandibles of (A) *Amiatus calvus*, and (B) *Pappichthys mongoliensis*, reduced to same size to show difference in shape.

Judging by the size of the mandibles, *Pappichthys mongoliensis* was a fish about as large as *P. corsoni* and *P. plicatus* of the Bridger beds (Eocene) of Wyoming, but smaller than *P. sclerops* and *P. lævis* of that formation. The latter two, as shown by the mandibles and vertebræ figured by Cope (4), must have been fishes about 7 feet in length, whereas the Mongolian species was about 5 feet.

In *P. sclerops* and *P. lævis*, the mandible is relatively deeper, and somewhat different in form from that of *P. mongoliensis*.

The two vertebræ included among the cotypes of *P. mongoliensis* (Figs. 11, 12), are very similar to the *Pappichthys* vertebræ figured by Cope from the Eocene of Wyoming (4). The abdominal vertebra shown in Fig. 12 is exactly of the size and form of those of *P. corsoni* shown in Cope's figures of that species.

NOTES ON ADDITIONAL SPECIMENS OF *PAPPICHTHYS*

In addition to the type material of *Pappichthys mongoliensis*, there are in the collection a number of isolated bones which had not been found previously in the genus, and a few other elements, like the mandibles, which, although already known, add somewhat to our knowledge of these structures. In the following notes these specimens are briefly described. They are illustrated in Figs. 14 to 22.

MANDIBLES AND DENTITION.—The fragment of a mandible shown in Fig. 22 is the first specimen of this bone found to show the teeth, all previous specimens having shown only the alveoli. Five teeth are preserved in this fragment. They are slender-conical, like those of the existing *Amiatus*, but larger.

This specimen is from the same formation and locality as the cotypes of *P. mongoliensis* and appears to belong to that species.

There is also in the collection a series of mandibles of *P. mongoliensis* of different sizes, all collected together. They grade from small, half-grown mandibles to large ones like the two included among the cotypes; they show that no material change took place in the shape of the mandible after the fish was half grown.

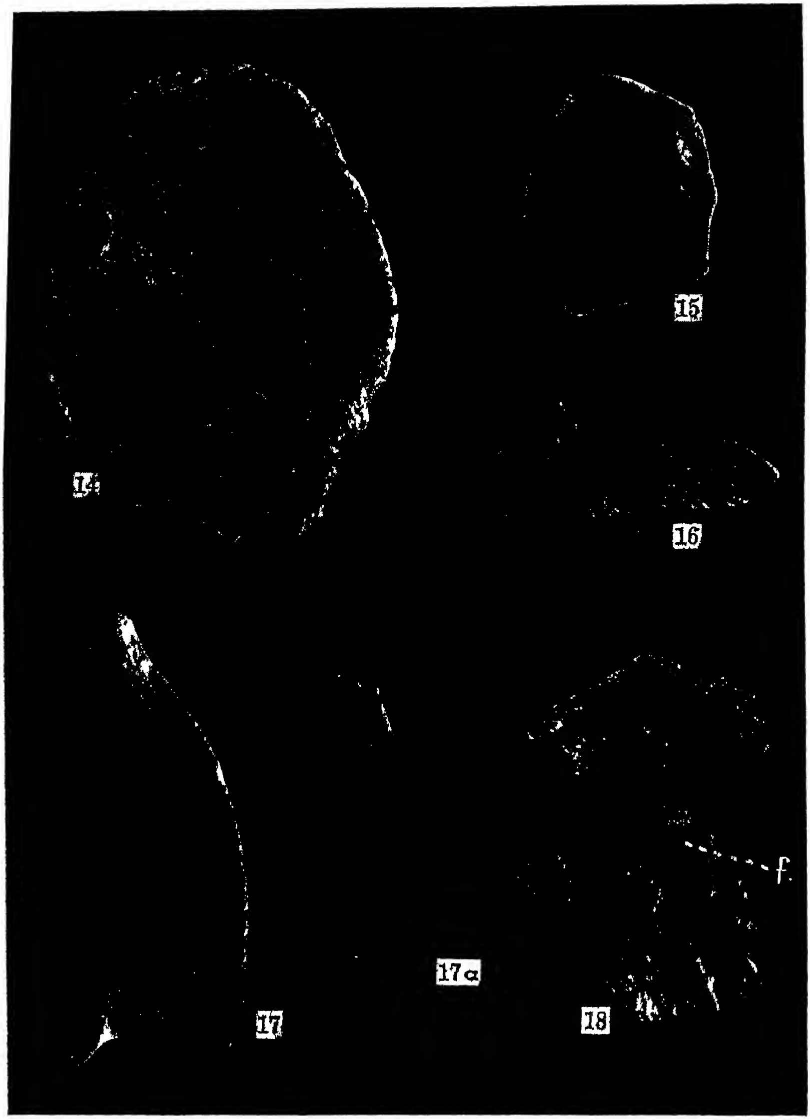
VOMERINE DENTITION.—With the mandibles just noted was found a fragment of the vomerine dentition. It consists of a patch of small, conical teeth set close together on a fragment of thin bone about half an inch in diameter. In both form and arrangement these teeth resemble the vomerine dentition of *Amiatus*.

SKULL ELEMENTS.—The skull of *Pappichthys* was heretofore known only by a few fragments (Cope, 4, Pl. III). In the present collection there are several complete, detached skull bones, collected with the cotypes of *P. mongoliensis*. These elements are all similar in form to their homologues in *Amiatus*, differing only in details. It thus appears probable that the head of *Pappichthys* was similar in shape to that of *Amiatus*.

SUPRATEMPORAL.—In Fig. 16 is shown one of the pair of supratemporals. In the Amiidæ these bones are elongated triangles placed transversely to form the posterior margin of the skull roof. The bone is of the same shape as in *Amiatus*, but somewhat more pointed. The ornamentation of the outer face is well shown in the figure.

OPERCULUM.—From an examination of *Amiatus* crania of different sizes, it appears that in the adult fish the operculum and suboperculum become ankylosed, the suture between them growing more or less obliterated. The same condition occurs in *Pappichthys*. The specimen in Fig. 15 is an operculum of a small fish, complete in itself, while that shown in Fig. 14 is the combined operculum and suboperculum of a large fish, with the suture between them only partly traceable.

The *Pappichthys* operculum is a little narrower proportionally to height than that of the bowfin; and the notch for the reception of the anterior extremity of the suboperculum is shallower (cf. Figs. 23A, B). The form of this notch appears to be constant for each species; I found it always of the same form in a number of *Amiatus* opercula examined. In *Pappichthys* the operculum is only scantily ornamented on the outer face, its upper third and the margin all around being almost smooth.



Figs. 14–18. *Pappichthys mongoliensis*, n. sp. About natural size.

14. Combined operculum and suboperculum of a full-grown fish: inner view. 15. Operculum of a young fish, inner view. 16. Supratemporal, outer view. 17. Ceratohyal. 17*a*. Ceratohyal of *Amiatus calvus* for comparison. 18. Hyomandibular; *f*, foramen.

HYOMANDIBULAR.—There is one example of this bone in the collection, the first to be found in the genus (Fig. 18). It is similar in general form to that of *Amiatus*, but the semicircular excision on the anterior margin is relatively deeper. The bone is twice as large as in *Amiatus*.

CERATOHYAL.—An incomplete right ceratohyal, collected with the cotypes, is shown in Fig. 17. As far as preserved, it is exactly of the form of this bone in *Amiatus*, cf. Figs. 17, 17a.

PECTORAL GIRDLE.—This is the first time that portions of the pectoral girdle of the genus *Pappichthys* have been found. Two of its elements are represented in the collection—the cleithrum, of which there are several specimens of different sizes, and a supracleithrum. From these bones it is evident that the pectoral arch of *Pappichthys* was similar in form to that of *Amiatus*, differing only in details.

Two specimens of the cleithrum are illustrated in Figs. 20, 21, one showing the entire vertical limb, the other the entire horizontal limb. The bone differs from that of *Amiatus* chiefly in the shape of the vertical limb, which is relatively broader and does not taper so much as in the existing genus.

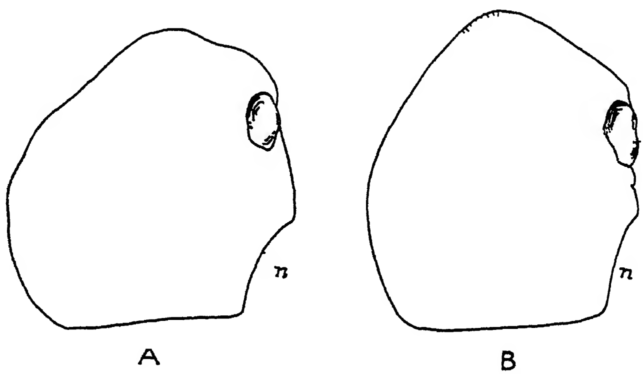


Fig. 23. Opercula of (A) *Amiatus calvus* and (B) *Pappichthys mongoliensis*, reduced to same size to show difference in outline and in the notch, *n*.

The supracleithrum is usually termed supraclavicle. But since the bone of the pectoral arch, once called clavicle, is now generally named cleithrum, it would appear more correct to term the bone overlying it, supracleithrum, not supraclavicle; I accordingly use this name for this element of the pectoral girdle.

The bone (Fig. 19) is similar in form to that of *Amiatus*, but twice as large. Its outer face is smooth save for a few faint vertical wrinkles near the lower margin.

MEASUREMENTS.—Height, 65 mm.; width (at middle of lower expanded portion), 20 mm. The corresponding measurements in a full-grown *Amiatus* are 33 mm. and 9.5 mm. respectively.

VERTEBRÆ.—Many vertebræ of different sizes, some as small as those of *Amiatus*, were collected from the Ulan Shireh beds in the Shara Murun region, the type locality of *Pappichthys mongoliensis*. They appear all to belong to this species. Six of them, selected as representative of the different forms and sizes, are shown in Fig. 24.

GEOLOGIC RANGE OF *PAPPICHTHYS* IN MONGOLIA

In addition to the foregoing specimens of *Pappichthys*, which are all from the Ulan Shireh beds, vertebræ of this genus were collected from two other Eocene formations. They are indistinguishable from those found in the Ulan Shireh, and I provisionally assign them to *P. mongoliensis*. The formations and localities from which they were collected are as follows:

(1) A dozen vertebræ of various sizes. Irdin Manha formation (Eocene); 23 miles south of Irdin Dabasu, Inner Mongolia. Expedition of 1923. Field No. 156.

(2) One large vertebra. Shara Murun formation (Eocene); Ula Usu, Inner Mongolia. Expedition of 1925.

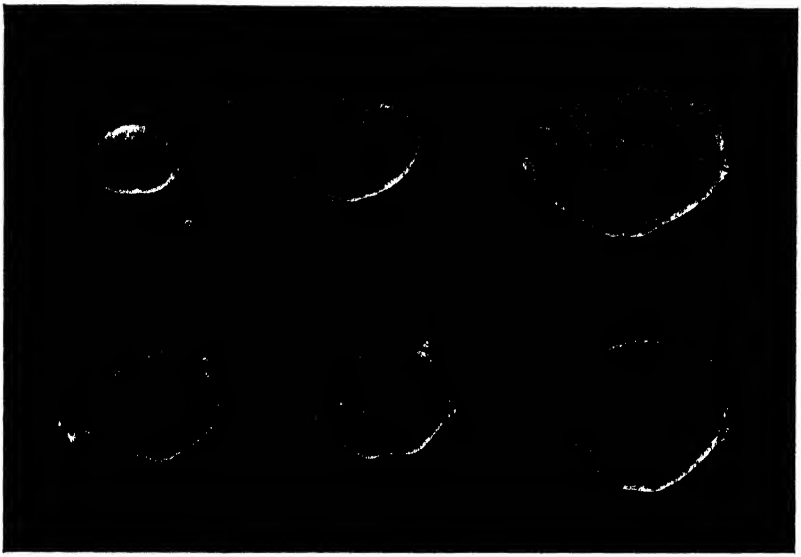


Fig. 24. *Pappichthys mongoliensis.* Six vertebræ of different sizes, selected from a group found together. Natural size.

The sequence of the formations in which *Pappichthys* was found, and their thicknesses, as determined by the geologists of the Central Asiatic Expeditions, are shown in the following table. The letter *P* indicates the formations in which *Pappichthys* was found.

Eocene	Shara Murun	200 ft. +	*P*
	Tukhum	150 ft. +	
	=Ulan Shireh		*P*
	=Irdin Manha		*P*

Pappichthys thus ranges through a thickness of more than 350 feet of strata, indicating that it existed in the Gobi region for an immense length of time. It is probable that during this vast time some specific differentiation occurred, and that more than the one species of *Pappichthys* described in this paper are represented among the isolated, partly worn vertebræ of different sizes collected by the expeditions. In the Eocene of western North America four species of *Pappichthys* have been found.

CATOSTOMIDÆ

Catostomus sp.

Figure 25A

Several detached bones of teleostean fish of the genus *Catostomus* were found with the *Pappichthys* remains, in the Ulan Shireh formation. The specimens include three opercula and two subopercula from fishes about 15 inches in length, and a few small vertebræ.

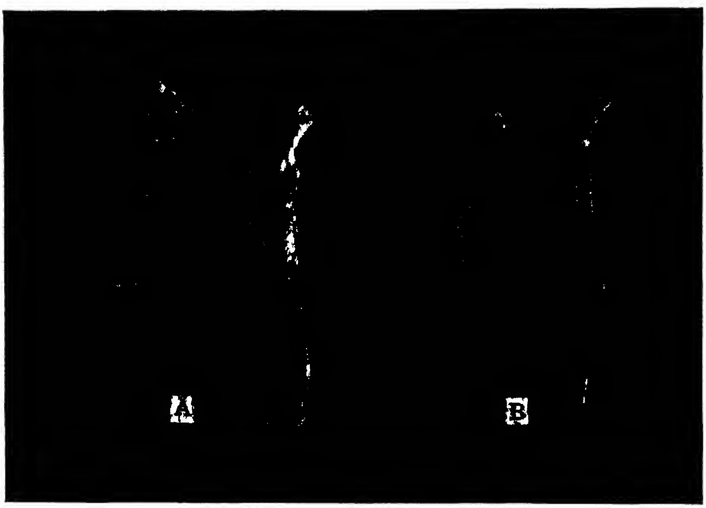


Fig. 25. A, Operculum of *Catostomus* from the Ulan Shireh formation; lower margin incomplete. B, same of *Catostomus commersonii*, a living species. Both in inner view; natural size

The operculum in the genus *Catostomus* (Fig. 25B) is distinguishable from that of related genera by the presence of a short, slender process at the upper anterior angle of the bone. This process is present in the Gobi operculum (Fig. 25A), making the generic identification practically positive.

The Gobi suboperculum is also similar in form to that of the Catostomidæ; it is almost exactly like that of *Catostomus commersonii*, a species now living in the rivers of temperate North America. In this living species the anterior margin of the suboperculum is drawn out upward into a sharp slender process. A similar slender process is present in the Gobi suboperculum.[1]

The Gobi species is probably new, but it seems to me that these two opercular bones alone do not afford sufficiently distinctive characters for describing it.

Along with these *Catostomus* bones was collected an operculum of a second genus probably of this family.

Judging by the character of the matrix, there appears to be no doubt that these catostomid bones are derived from the Ulan Shireh beds and not from a later formation. Hence we have here a *Catostomus* of undoubted Eocene age. This makes this family one of the most ancient of living teleosts.

The Catostomidæ were previously known by fossils from as early as the Miocene, being represented by the genus *Amyzon* in the Florissant shales of Colorado and an equivalent formation in British Columbia.

SILURIDÆ

The expedition of 1930 obtained two pectoral spines of a new species of catfish of the genus *Rhineastes*. This genus is known only by fossil fin-spines.

Rhineastes grangeri, new species

Figure 26

TYPE.—Proximal half of a right pectoral fin-spine (Fig. 26). Length as far as preserved, 4 cm. The specimen is in the American Museum of Natural History.

FORMATION AND LOCALITY.—Tung Gur beds (Pliocene); 50 miles southeast of Iren Dabasu, Inner Mongolia.

Pectoral spine about 7 cm. in length—indicating a catfish of 1½ to 2 feet. Sides of spine ornamented with incised lines, which in places produce the effect of low flutings; these are here and there broken up into elongated dots and short, irregular lines. Posterior margin of spine bears large denticles of the form shown in Fig. 26*d*. They are not compressed, and the outer surface of each denticle (i. e., the surface facing the point of the spine) has a shallow channel extending to the point of the denticle. The anterior margin of the spine bears a row of very small, rounded nodes (rather worn and inconspicuous in the type), separated by slight distances, thus giving the cutwater edge of the spine a compressed, delicately serrated edge.

---

[1]The Gobi specimen showing this process was accidentally damaged while being repaired for me in the palæontological laboratory.

Cross-section of spine, at its middle, approximately elliptical, the long axis of the ellipse about 1½ times the shorter one.

Named for Dr. Walter Granger, Curator of Fossil Mammals in The American Museum of Natural History, and chief of the palæontological division of the Central Asiatic Expeditions.

A second spine of this form was obtained by the 1930 expedition from the same formation as the type, at a locality 40 miles southeast of Iren Dabasu. (Field No. 833.)

This specimen is a little more compressed than the type; the incised lines on the sides are more regular, and the posterior denticles do not show the channeling on the front face clearly (perhaps due to weathering). The fine nodes along the anterior margin, on the other hand, are more distinct than in the type.

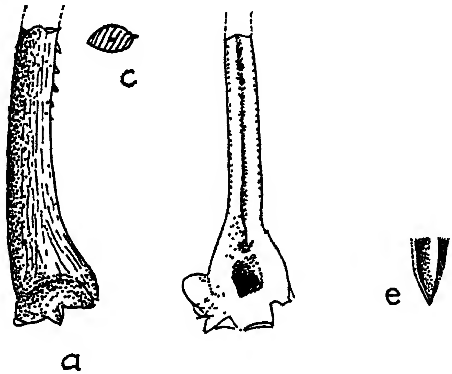


Fig. 26. *Rhineastes grangeri*, n. sp.

a, Type, from the side, natural size; *b*, type, in posterior view; *c*, cross-section of type; *d*, two of the posterior denticles, enlarged. *e*, upper view of a denticle enlarged to show channeling.

This specimen seems to me to be of the same species, *Rhineastes grangeri*, but from a younger fish.

Rhineastes grangeri has a general resemblance in size and form to the catfish spine named by Cope *Rhineastes smithi*, from the Middle Eocene (Bridger beds) of Wyoming (4, Pl. v, figs. 10, 10*a*), but it differs in details, indicating specific distinction between the two fishes.

I have compared *Rhineastes grangeri* with pectoral spines of various catfishes now living in China (e.g., *Clarias*, *Pseudobagrus*, etc.). It resembles them in general form, but in all the Chinese genera I examined the pectoral spines are much more compressed, and the posterior serratures are proportionally very much larger or considerably smaller. Of all the catfish genera with which I compared the *Rhineastes* spines, I find the closest agreement to be with some species of *Arius* of South America.

LITERATURE CITED

1. BERKEY, CHARLES P., AND MORRIS, F. K. 1927. Geology of Mongolia. Natural History of Central Asia, II. Amer. Mus. Nat. Hist., New York.

2. COCKERELL, T. D. A. 1924. Fossils in the Ondai Sair Formation, Mongolia. Bull. Amer. Mus. Nat. Hist., LI, pp. 129–144, 2 pls.

3. 1925. The Affinities of the Fish *Lycoptera middendorffi*. Bull. Amer. Mus. Nat. Hist., LI, pp. 313–317, Pl. III.

4. COPE, E. D. 1883. Vertebrata of the Tertiary Formations of the West. Rept. U. S. Geol. Surv. Terr., III.

5. EICHWALD, EDOUARD D'. 1865. Lethaea Rossica ou Paléontologie de la Russie, II. Stuttgart. (*Lycoptera*, pp. 1200–1203, Pl. XXXVIII).

6. GRABAU, A. W. 1923. Cretaceous Fossils from Shantung. Bull Geol. Surv. China, No. 5, Part 2, pp. 143–181, 2 pls.

7. HAY, O. P. 1929. Second Bibliography and Catalogue of the Fossil Vertebrata of North America. Carnegie Instn. Washington, 2 vols. (References to American records of *Pappichthys*, I, p. 715).

8. JORDAN, D. S. 1917. The Genera of Fishes [Part I]. Leland Stanford Jun. Univ. Publications.

9. MÜLLER, JOHANNES. 1847. *In*, A. Th. v. Middendorff: Reise in den Äussersten Norden und Osten Sibiriens Wahrend der Jahre 1843 und 1844. St. Petersburg, 1847. Fossile Fische. Bearbeitet von Johannes Muller, I, pp. 261–263.

10. REGAN, C. TATE. 1911. The Classification of the Teleostean Fishes of the Order Ostariophysi——1. Cyprinoidea. Ann. Mag. Nat. Hist., Ser. 8, VIII, pp. 13–32.

11. REIS, OTTO M. 1909. Die Binnenfauna der Fisch-schiefer in Transbaikalien. Recherches Géol. Min. le long du chemin de fer de Sibérie. St. Petersburg, Livr. XXIX, pp. 1–68, 5 pls.

12. WOODWARD, A. S. 1901. Catalogue of the Fossil Fishes in the British Museum (Natural History). Part IV.

AMERICAN MUSEUM NOVITATES

Number 554 | Published by The American Museum of Natural History New York City | August 22, 1932

59.86 (81)

THREE NEW BIRDS FROM NORTHWESTERN BRAZIL

By Elsie M. B. Naumburg

Mr. Emil Kaempfer and his wife have been collecting birds for Mrs. Elsie M. B. Naumburg, since January, 1926, in Maranhão in northeastern Brazil southward to the adjoining parts of Uruguay and Paraguay. The result is a superb assemblage of well-prepared specimens adequately representing the bird-life of an area from which the American Museum had a very limited amount of material.

Mrs. Naumburg has generously presented this valuable collection to the American Museum and, beginning with the birds from Maranhão, Piauhy, Ceará, Pernambuco, and Bahia, will prepare a series of papers, of which this is the first.—F. M. Chapman.

Nothura maculosa cearensis, new subspecies

Subspecific Characters.—Most nearly related to *Nothura maculosa boliviana* Salvadori but wings much shorter, blackish markings on foreneck reduced in size, forming shaft-streaks rather than spots or cross-bands; upper wing-coverts decidedly paler ochraceous; the light bars on the back somewhat paler rufescent brown.

Type.—No. 241,006, Amer. Mus. Nat. Hist.; adult male; Lavras (alt. 900 ft.), Ceará, Brazil; December 13, 1926; Emil Kaempfer. Wing, 114; culmen, 18 mm.

Although it is risky to separate a new form on the basis of a single specimen, I think that I am fairly safe in naming this Ceará bird, its difference in size being so marked and the region whence it comes being so far from the range of *N. m. boliviana*, its nearest relative. In shape of bill, as well as in pattern of coloration (dorsal feathers black with several rufescent cross-bands and a conspicuous lateral margin of buff on each side), it resembles the other members of the *N. maculosa* group, but approaches *N. minor* (Spix) in shortness of wings. *N. minor*, however, is immediately recognizable by its more slender (though not always shorter) bill; bright chestnut rufous upperparts which, instead of being crossed by some widely separated bars, of ochraceous brown or dull rufescence, are closely vermiculated with blackish; more rufescent upper wing-coverts with more closely set black barring; and deeper, more tawny-ochraceous ventral surface with much more narrowly barred flanks.

It is certainly erroneous to treat *N. minor* as a race, since it lives side by side with *N. maculosa maculosa* in certain parts of southeast-

ern Brazil. Natterer obtained both of them at Itararé, São Paulo, and Reinhardt at Lagôa Santa, Minas Geraes.[1] The only other *Nothura* that I have seen from northeastern Brazil is *N. boraquira* (Spix), which is quite distinct specifically from any other member of the genus. In the Abh. K. Bayer. Akad. Wiss., 1906, II. Kl., XXII Bd., III Abt., Dr. C. E. Hellmayr (Revis. Spix, p. 705) has pointed out its characters at length.[2]

Specimens Examined and Measurements[3]

		Wing	Culmen	Museum
Nothura maculosa maculosa[4]				A.M.N.H.
Paraguay: Rio Paraguay, Puerto Pinasco	♂	129	17	(Roosevelt Coll.)
" " " "	♀	136	18 5	" "
" Paraguayan Chaco, Fort Wheeler	♀	126	20	" "
" Asuncion	♀ juv.			" "
				Vienna Mus.
Brazil: São Paulo, Itararé	♂	137	20	(Natterer Coll.[5])
" " " Ypanema	♂	127	19	" "
" " " "	♀	135	18	" "
" " " Pederneiras	♀	133	19	" "
" " " Lambari	♀	128	20	" "
				H. B. Conover
" Goyaz, Veadeiros, Mt. Cavalcanti	♀	137	20	(Field Coll.)
" " " "	♀	122	19	" "
Nothura maculosa cearensis				A.M.N.H.
Brazil: Ceará, Lavras	♂	114	18	(Kaemper Coll.)
Nothura maculosa boliviana				
Bolivia: Prov. Cochabamba, Cuchacancha (alt. 11,000 feet)	♂	140	18	A.M.N.H.
" " " "	♂	129	16	"
" " " "	♂	121	17	"
" " " "	♀	131	15.5	"
" " " "	♀	141	18	"
" " " "	♀	130	17	"
Bolivia: Prov. Cochabamba, Mizque (alt. 7500 ft.)	♂	130	19	"

[1]Note from Dr. C. E. Hellmayr.

[2]*N. boraquira* of Salvadori, from northwestern Argentina (1895, 'Cat. Birds Brit. Mus.,' XXVII, p. 561), however, is a very different thing, being a race of *maculosa*, and was renamed *salvadorii* by Hartert (1909, Nov. Zool., XVI, p. 266).

[3]See Reichenberger: 1923, 'Remarks on Methods in Measuring Birds,' Auk, XI, p. 246. From now on I shall follow the English and continental method of measuring the wing which I suggested (but did not use) in my former papers, having used dividers up to the present time.

[4]Dr. Hellmayr examined the type of *N. media* for me in Munich. It is a large bird (wing, 138–140) of *maculosa* coloration, undoubtedly a synonym of *N. m. maculosa*, and has nothing in common with *N. m. cearensis*.

[5]Measurements sent to me from Vienna by Dr. Hellmayr.

Columba picazuro marginalis, new subspecies

SUBSPECIFIC CHARACTERS.—Adult: similar to typical *C. p. picazuro* from Paraguay, but on the average smaller; underparts clearer and brighter vinaceous pink; breast and abdomen not at all grayish; white edges to outer and greater upper wing-coverts much broader, forming a much more prominent longitudinal stripe on the wing; dorsal coloration paler with more conspicuous pale brownish or whitish-brown apical edges to scapulars and inner upper wing; rump and tail-coverts lighter slate-gray.

TYPE.—No. 241,020, Amer. Mus. Nat. Hist.; adult male; Corrente (alt. 1500 ft.), Piauhy, Brazil, May 29, 1927; Emil Kaempfer. Wing, 222; tail, 120; culmen, 19.5 mm.

RANGE.—Brazil (Piauhy): Corrente (alt. 1500 ft.); Parnaguá (alt. 1000 ft.); Bello Horizonte, near Therezina; Floriano, Ibiapaba, Urussuhy. Brazil (Bahia): Remanso (alt. 1300 ft.); Barro do Rio Grande (alt. 1400 ft.); Santa Rita do Rio Preto (alt. 1600 ft.); Soledade, Rio São Francisco.

This new form from the arid catinga region of Piauhy and Bahia differs from *C. p. picazuro*, of Paraguay, extreme southern Brazil, Bolivia, and Argentina, in its average smaller size and paler color of the upperparts, this color being especially noticeable on the rump and upper tail-coverts. The pileum and nape are of a paler vinaceous hue, lightest on the forehead, while in the typical form the crown is considerably darker. The underparts are a clearer vinaceous color, with a perceptible rosy tinge, while in the typical race the chest and foreneck are darker, passing into dull grayish posteriorly. There is a slightly lighter chin-spot in the new form, while in the birds from Paraguay the vinaceous color of the chin is washed with brownish. The most striking character, however, is the greater extent of white on the wing-coverts, these edges being from two to three times wider than in typical *picazuro*.

In the 'Ornithology of Northeastern Brazil,'[1] Dr. C. E. Hellmayr points out the difference in size mentioned above, though he says his single specimen from Piauhy (Ibiapaba) is exactly duplicated by an adult male from Rio Colorado, Tucumân, and another from Buena Vista. I have seen a good series from Argentina and Bolivia and cannot concur with this statement, as the specimen from Piauhy (Ibiapaba), in the Conover Collection in Chicago, agrees in its smaller size and lighter color, and in the broad edges of the upper wing-coverts, with the series from Piauhy of *C. p. marginalis* in the Kaempfer Collection. The specimen from the Rio Colorado, Tucumân, Argentina, in the Conover Collection, though admittedly not quite as dark as other specimens from

[1]Field Mus. Nat. Hist., Pub. 255, Zool. Ser., p. 462.

Argentina, in no way approaches, either in small size or in the broad markings of the wing-coverts, the series from Piauhy. I now believe that *C. p. venturiana* Hartert[1] is identical with the typical race from Paraguay. Dr. Hellmayr now thinks that *C. p. marginalis* is a valid form which can be distinguished immediately by the uniform vinaceous-pink coloration of the underparts (whereas in typical *picazuro* the breast and abdomen are pale brownish-gray with a hardly perceptible pinkish hue) and by the much broader white edges to the outer and greater upper wing-coverts.

At the time of describing this form, Hartert compared it with specimens from Goyaz, Brazil, which he believed represented *C. p. picazuro*, but which are likely to belong to *C. p. marginalis*. I may mention in this connection that Wetmore (1926, Bull. U. S. Nat. Mus., No. 133, p. 184) is in error in applying the name *C. reichenbachi* Bonaparte to a member of this group, as was ascertained by Dr. Hellmayr upon re-examination of the original examples in the Paris Museum.

Specimens Examined

Columba picazuro marginalis.—Piauhy (Brazil): Corrente (alt. 1500 ft.), 2 ♂ ad., 1 ♀ ad., May 29, 1930, and June 6, 1927; Floriano, on the Rio Parnahyba, on the way to Nova York, 1 ♂ ad., July 6, 1926; Bello Horizonte, on the Rio Parnahyba, 1 ♂ ad., August 8, 1926; Parnaguá (alt. 1000 ft.), 1 ♀ ad., June 15, 1927 (Kaempfer Coll., A.M.N.H.), 1 ♂ ad. (Vienna Museum); Ibiapaba, 1 ♂ ad., January 16, 1925 (Conover Coll., Chicago). Bahia (Brazil): Barra do Rio Grande (alt. 1400 ft.), 1 ♂ ad., April 13, 1927 (Kaempfer Coll.), 1 ♂ ad., 1 ♀ ad. (Vienna Museum); Remanso, on the Rio São Francisco (alt. 1300 ft.), 1 ♂, 1 ? (molting from juvenal to adult plumage), April 5, 1927; Santa Rita do Rio Preto (alt. 1000 ft.), 1 ♀ ad., August 2, 1927 (Kaempfer Coll.); Soledade, 1 ♀ ad. (Vienna Museum).

Columba picazuro picazuro.—Paraguay: Belém on the Rio Ypané (alt. 300 ft.), 1 ♂ ad., August 11, 1930 (Kaempfer Coll.); Paraguayan Chaco, Fort Wheeler, 1 ♂ ad., September 29, 1916 (Roosevelt Exped.). Brazil, Rio Grande do Sul: São Lourenço, 1 ♂ ad., December 28, 1884 (coll. by Dr. H. von Ihering); Lagôa do Forno, near Torres (sea-level), 1 ♀ ad., October 27, 1928 (Kaempfer Coll.). Bolivia: Dept. Santa Cruz, Buena Vista, 3 ♂ ad., 1 ♀ ad., July 5–22, 1925–1928, 2 ♂ ad., October 4–11, 1923, 1927, 1 ♂ ad., September 22, 1926. Argentina: Tucumán, Tapia (alt. 1500 ft.), 1 ♂ ad., August, 1927; Rio Colorado (alt. 1200 ft.), 1 ♂ ad., June 28, 1904; Prov. of Salta, Bank of Rio Bermejo, June 27, 1911; Missiones, Santa Anna, 3 ♂, 1 ♀ ad., July, 1923; Buenos Aires, Los Ingleses Ajó, 1 ♀, July 9, 1909; Santa Catharina, 1 ♂ ad., April 18, 1900 (Conover Coll., Chicago).

[1]1909, Nov. Zool., XVI, p. 260; Mocovi, Prov. Santa Fé, Argentina.

Measurements

		Wing (shortest and longest)	Tail (shortest and longest)	Museum
Columba picazuro marginalis				A.M.N.H.
Brazil: Piauhy, Corrente,	2 ♂ ad.	209–225	118–121[1]	(Kaempfer Coll.)
" " Floriano,	1 ♂ ad.			" "
" " Bello Horizonte,	1 ♂ ad.			" "
" " Urussuhy,	1 ♂ ad.			" "
" " Ibiapaba,	1 ♂ ad.	200	112.5	Field (Conover Coll.)
" " Parnaguá,	1 ♂ ad.	218	120	Vienna[2]
" Bahia, Barra do Rio Grande	1 ♂ ad.	221–224		A.M.N.H.
" " Remanso	1 ♂ ad.			(Kaempfer Coll.)
" " Santa Rita do Rio Preto	1 ♀	213		" "
" " Soledade	♂ ad.	225	120	Vienna
" " Barra do Rio Grande	♂ ad.	212	120	"
" " Barra do Rio Grande	♀ ad.	210	117	"
Columba picazuro picazuro				
Paraguay: Belém	1 ♂	210–238	115.0–126	"
" Ft. Wheeler	1 ♂			
Brazil: Rio Grande do Sul, São Lourenço	1 ♂			
" Rio Grande do Sul, Lagôa do Forno (near Torres)	1 ♀	236	135	"
" Matto Grosso, Cuyabá[3]	1 ♂ ad.	215	114	Vienna
" " "	1 ♂ ad.	231	115	"
" " "	1 ♀ ad.	218	112	"
" " "	1 ♀ ad.	230	120	"
" Santa Catharina	1 ♂ ad.	240	135	Field (Conover Coll.)
Bolivia: Dept. Santa Cruz, Buenavista	5 ♂ ad.	222–230	118.5–132	" "
Bolivia: Dept. Santa Cruz, Buenavista	1 ♀ ad.	214	117.5	" "

[1]Only four tails measured, as one was incomplete.

[2]The Vienna Museum has, besides an egg and a half-grown young, four adults all collected by O. Reiser: Soledade, Rio São Francisco, Bahia, 1 ♂ ad.; Barra do Rio Grande, Bahia, 1 ♂ ad.; Parnaguá, Piauhy, 1 ♂ ad. (Information given to me by Dr. C. E. Hellmayr.)

[3]According to Dr. C. E. Hellmayr, birds from Cuyabá, Matto Grosso (four adults), in Vienna Museum, are typical of the dark southern form (*picazuro*) and agree with Argentina specimens.

			Wing (shortest and longest)	Tail (shortest and longest)	Museum
Argentina:	Missiones, Santa Ana	3 ♂ ad.	222–231	121.5–132.5	Field (Conover Coll.)
"	Missiones, Santa Ana	1 ♀ ad.	222.5	125.5	" "
"	Buenos Aires,	1 ♀ ad.	227.5	123	" "
"	Tucumán, Tapia,	1 ♂ ad.	215.5	110	" "
"	Rio Colorado	1 ♂ ad.	230.5	121	" "

Crypturellus tataupa septentrionalis, new subspecies

SUBSPECIFIC CHARACTERS.—Most nearly related to *Crypturellus t. tataupa* from Paraguay and southeast Brazil, but culmen on average shorter; back of head on average lighter gray; upperparts somewhat lighter than umber-brown instead of darker than natal brown (Ridguay, Pl. XL.). Wing, 125 mm.; culmen, 22 mm.

TYPE.—No. 240,968, Amer. Mus. Nat. Hist.; adult male; Corrente[1] (alt. 1500 ft.), Piauhy, Brazil, June 19, 1927; Emil Kaempfer.

RANGE.—Brazil: in the states of Maranhão (Parnahyba, Flores, mouth of Balsa River, Barra de Grajau near Floriano, São João dos Patos); Piauhy (Correntes); and Bahia (Fequié, Iracem, Morro de Chapeu, Santa Rita).

All the specimens from Maranhão, Piauhy, and Bahia, Brazil, are uniformly lighter than umber-brown, lighter than the birds from Paraguay and Espirito Santo and Santa Catharina, Brazil. The sides of the northeast Brazilian birds are lighter grayish; the lower flanks are lighter, each feather having a broader edge of whitish buff, and a whiter crescent-shaped mark; the under tail-coverts are lighter buff, with paler buff edges to the irregular V-shaped bars of the feathers. The remiges are bright rufous brown like the upperparts; the under wing-coverts grayish tinged with brownish instead of darker than natal brown. The length of the culmen and the chin-spot (pale to dark gray) appear to be variable characters, while the difference in coloration throughout holds between northern and southern specimens.

Birds from Matto Grosso are not as dark (darker than natal brown) above as specimens from Santa Catharina, Espirito Santo, and Paraguay, and are not as bright (brighter than umber-brown) as specimens from Maranhão, Piauhy, and Bahia. In length of culmen they agree with specimens from northeast Brazil, showing the almost usual intergradation of the Matto Grosso faunal area. On the other hand, specimens from Santa Catharina have all the characters most strongly and more markedly defined. They are darkest on the back of the head which is

[1]On the Parnahyba, near Gilbúes, in the valley of the Corrente River.

blackish gray, much darker than natal brown above, and have the longest culmen.

Plumages

Adult Females.—Similar to males.

First Annual Plumage.—This is cinnamon color and lighter than umber-brown above; the back of the head and neck are paler gray; feathers of the occiput faintly tinged with cinnamon; below, chin and throat grayish, as in the adult bird, becoming pale buffy on the lower throat and upper breast, each feather narrowly barred, giving a very faint vermiculated pattern. This pattern extends irregularly to lower breast and sides; the lower flanks are less black and more cinnamon rufous, each feather edged with white instead of whitish buff, and having a white V-shaped mark. The under tail-coverts are paler ochraceous with irregular faint bars; rectrices bright cinnamon like the upperparts but the latter also faintly barred. The under wing-coverts gray tinged with brownish as in the adult bird. Tarsus and middle toe shorter than in the adult bird and yellow instead of dark gray in color.

Juvenal Plumage.—This plumage is similar in coloration to the birds in the first annual plumage. The wings have distinct transverse white and black marks. The underparts, rump, and rectrices are more strongly barred.

This species inhabits the Chapada and Catinga country. It is found in the thick underbrush with some forest and inhabits wide stretches under cultivation.

If one compares Azara's description of "Le Tataupa" (French edition, IV, p. 152) and that of Temminck ('Hist. Nat. Pig. Gall.,' III, p. 592) one cannot fail to notice the differences, and it is quite evident that Temminck drew up an independent description of the bird from one of the Brazilian specimens handled by him. From Azara he merely quotes the notes on its habits and behavior.

In cases like this, where the author of the scientific name basis his account both on earlier names and on descriptions which represent two distinct forms, it becomes necessary to restrict the names to one of the two components. Since Temminck had specimens from "Brazil," it is perhaps advisable to restrict the name to this form. According to Dr. Hellmayr, "Brazil" doubtless means southern Brazil, which should, therefore, be taken as type locality of *Tinamus tataupa* Temminck.

According to Temminck several specimens were sent to the "Cabinet de Curiosités" in Lisbon and two are in the museum at Paris.

The name *tataupa* signifies "Ynambu de Cheminée," because the bird is usually found near farms "et voisines des cantons les plus couverts et s'approche ordinairement des habitations champêtres."

Crypterullus tataupa septentrionalis

		Culmen	Museum A.M.N.H.
Brazil: Piauhy, Correntes (alt. 1500 ft.)	7 ♂ ad.	(16-22 mm.)[1]	(Kaempfer Coll.)
" " " " " "	5 ♀ ad.	(18-23)	"
" Bahia, Fequié (" 800 ")	1 ♀ ad.	19	"
" " Iracem (" 2300 ")	1 ♀ ad.	26	"
" Morro de Chapeu (" 3600 ")	1 ♀ ad.	17	"
" Santa Rita (" 1600 ")	1 ♀ ad.	22.5	"
" Maranhão, Parnahyba, Flores	1 ♂ ad.	16	"
" " " mouth of Balsa River; " " Parnahyba, Barra de Grajau (near Floriano); " " São João dos Patos (alt. 700 ft.)	4 ♀ ad.	(16–19.5)	

Crypterullus tataupa tataupa

		Culmen	Museum
Brazil: Santa Catharina, Salto Pirahy (alt. 450 ft.), near Joinville	1 ♂ ad.	24.5[2]	A.M.N.H. (Kaempfer Coll.)
" " " " "	1 ♂ ad.	24	"
" " " " "	1 ♀ ad.	25	"
" " " " "	1 ♀ ad.	26[3]	"
Brazil: Espirito Santo, Baixo Guandú	1 ♂ ad.	24.5	A.M.N.H. (Kaempfer Coll.)
" " " " "	1 ♂ ad.	23	"
" " " " "	1 ♀ ad.	23	"
" " " " "	1 ♀ ad.	25	"
" " " " "	1 ♀ ad.	25	"
Paraguay: east of Villa Rica, Colonia Independencia	1 ♂ ad.	23	"
" " "	1 ♀ ad.	23	"
" " "	1 ♀ ad.	25.5	"
" " "	1 ♀ ad.	23	"
Eastern Paraguay: upper Iguarú River	1 ♀ ad.	21	"

---

[1] The wing measurement is a variable character in *Crypturellus t. tataupa* and *Crypturellus t. septentrionalis*, ranging from 115 mm. to 139 mm. in both races.

[2] One male and two females very dark, possibly averaging darker than specimens from Paraguay and Espirito Santo.

[3] According to Dr. Hellmayr, two specimens collected by Othmar Reiser at Buriti, near Parnaguá, Piauhy, bear out the characters of my new form. The brownish wash on the hind crown, however, seems to be largely due to immaturity, but the pileum is less blackish on *septentrionalis*.

		Culmen	Museum
Eastern Paraguay: Rio Negro	1 ♂ ad.	20 5	A.M.N.H. (Roosevelt Coll.)
Brazil: Matto Grosso, Urucum, near Corumbã	1 ♀ ad.	19	"
" southern Matto Grosso, Companario, São Francisco Ranch	1 ♀ ad.	18	A.M.N.H. (Kaempfer Coll.)
" " " "	1 ♂ ad.	17	"
" southern Matto Grosso, Rio Amambay	1 ♀ ad.	[1]	"

[1]Culmen broken.

AMERICAN MUSEUM NOVITATES

Number 555 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Sept. 6, 1932

59 57, 89 H (87)

HESPERIIDÆ (LEPIDOPTERA, RHOPALOCERA) OF THE RORAIMA AND DUIDA EXPEDITIONS, WITH DESCRIPTIONS OF NEW SPECIES

BY E. L. BELL

It has been the privilege of the writer to examine the Hesperiidæ collected by Mr. G. H. H. Tate on two expeditions to the northern part of South America organized under the auspices of The American Museum of Natural History. The first of these expeditions was to Mt. Roraima, which lies at the junction of the boundaries of extreme northern Brazil, Venezuela, and British Guiana, and is known as the "Lee Garnett Day Expedition" to Mt. Roraima. The expedition was made during the latter part of 1927 and extended to the first part of January, 1928. The course taken was up the Amazon, Rio Negro, Rio Branco, and Rio Cotinga to the village of Limao, the limit of navigation, thence overland approximately one hundred miles to Mt. Roraima. The return trip was through British Guiana via the Copenang and Potaro Rivers to Georgetown.

The second expedition, the "Tyler Duida Expedition," was to Mt Duida, which lies about four hundred miles west by south of Mt. Roraima, at the western end of the Parima Mountains, in southern Venezuela. It was made during the latter part of 1928 and the first part of 1929. The course taken was up the Amazon and Rio Negro, and by way of the Casiquiare Canal to the Orinoco. A base was established at Esmeralda, on the Orinoco, eight miles south of Mt. Duida.

About three months' time was spent on the top of the mountain. The return trip was made over the same course.

Several papers have been published on the results of the two expeditions.[1] In addition, other papers have been published on specialized subjects. There are excellent maps accompanying some of the papers. Mr. Tate has a contribution in press, to appear in Ecology, which will contain a full bibliography of the papers dealing with the results of the Roraima expedition.

[1]Dr. F. M. Chapman, 1929, 'Descriptions of New Birds from Mt. Duida, Venezuela,' American Museum Novitates, No. 380, and 1931, 'The Upper Zonal Bird Life of Mts. Roraima and Duida,' Bull. American Museum of Natural History, LXIII, Article I. H. A. Gleason, 1931, 'The Botanical Results of the Tyler Duida Expedition,' Torrey Botanical Bulletin, LVIII, Nos. 5, 6, 7, 8, with an index in No. 9. G. H. H. Tate, 1930, 'Notes on the Mount Roraima Region,' The Geographical Review, XX, No I, pp. 53–68; G. H. H. Tate and C. B. Hitchcock, 1930, 'The Cerro Duida Region of Venezuela,' The Geographical Review, XX, No. I, pp. 31–52.

The small number of species of Hesperiidæ taken on these two expeditions can represent but a small fraction of those to be found in these two isolated regions and it is remarkable that this small number should contain several that appear to be undescribed. Twenty-one specimens representing fifteen species were collected during the expedition to Mt. Roraima; forty-three specimens distributed among twenty-nine species on the Mt. Duida expedition. The distribution of the species overlaps but slightly; three and possibly a fourth species were taken on both expeditions. The combined number from the two expeditions is sixty-four specimens representing forty or forty-one species, of which thirty are identified as known species, and seven described as new. Another may be the same as one of the newly described species, but certain differences in maculation render it impossible to positively identify it as such; and the male, having lost the abdomen there is no means of checking it up. Three species are represented by females which the writer is unable to identify as belonging to any of the species known to him. With the exception of the allotype and paratypes of one of the newly described species, all of the specimens recorded here were taken by Mr. G. H. H. Tate.

A list of the localities, with the data pertaining to them, precedes the list of species taken on each expedition. To avoid repetition, the data are omitted under the individual record of each species.

LEE GARNETT DAY EXPEDITION TO MT. RORAIMA

Brazil

Paulo.—Ten miles southwest of Mt. Roraima, 4000 feet altitude.

Arabupu.—Ten miles southeast of Mt. Roraima, 4200 feet altitude. Savannas.

Rondon Camp, Mt. Roraima.—6900 feet altitude. Rain-forest belt.

British Guiana

Anundabaru.—Headwaters of the Copenang River, one hundred miles east of Mt. Roraima, 2000 feet altitude.

Tukeit, Potaro River, 2000 feet altitude.

Pyrrhopyginæ

Mysoria acastus Cramer

Paulo, Brazil, October 29, 1927, 1 ♂.

This specimen has the orange marginal area of the secondaries

beneath extremely wide, occupying nearly the entire outer half of the wing opposite the cell. It lacks the red costal marginal stripe on the under side of the secondaries, which is present in the form *M. venezuelæ* Scudder, and thus agrees in this characteristic of *acastus* which Cramer described from "Les Berbices and Surinam."

Jemadia azeta Hewitson

Anundabaru, British Guiana, January, 1928, 1 ♂.

This specimen is very lightly marked on the upper side, the lower half of the submarginal band of the secondaries being present only in the form of a very thin line of blue scales. An examination of the genitalia conclusively proved the specific identity of this specimen. The species has been recorded from Guatemala to southern Brazil.

Pyrginæ

Goniurus eurycles Latreille

Arabupu, Brazil, December 26, 1927, 1 ♂, 1 ♀.

Anundabaru, British Guiana, January, 1928, 1 ♀.

The Arabupu specimens have the maculation of the primaries very much reduced. In the male the subapical spots are entirely absent on the upper side, the discal band is represented by a barely discernible streak in the cell and a minute dot immediately below it; on the under side the subapical spots and the band are more plainly present. The female has the subapical spots on the upper side of the primaries reduced to two small dots and the discal band is very narrow, both being plainer beneath. This species is widely distributed in Central and South America and in Trinidad and is usually extremely abundant.

Chioides catillus Cramer

Paulo, Brazil, October 29, 1927, 1 ♂.

Widely distributed from Costa Rica to southern Brazil and in some of the West Indian islands.

Autochton itylus Hübner

Arabupu, Brazil, December 26, 1927, 2 ♂.

Recorded from Guiana to Brazil.

Entheus priassus Linnæus

Anundabaru, British Guiana, January, 1928, 1 ♀.

Recorded by Godman and Salvin, in the 'Biologia Centrali-Americana,' from Colombia to southern Brazil.

Pellicia macarius Herrich-Schäffer

Tukeit, British Guiana, January, 1928, 2 ♀.

Recorded by Godman and Salvin from Mexico to the Amazon valley and there are specimens in the writer's collection from Ecuador, Peru, southern Brazil, and Trinidad.

Hesperiinæ

Chærephon lindseyi, new species

Figure 7

Male.—Upper side light brown. Primaries with a poorly defined yellowish-white spot in interspace 2, a similarly colored smaller spot obliquely above it in interspace 3, and three small, ill-defined subapical spots of the same color. The discal spots are small and sometimes very minute. There are sparse fulvous scales along the costal margin, a fulvous reflection in the basal half of the wing and externally bordering the stigma, and some olive-brown hairs along the inner margin of the wing. The stigma is prominent and of the form found in this genus. The secondaries have olive-brown hairs in the disc and along the abdominal fold, with or without an ill-defined discal band of three or four small pale spots. Fringes of both wings are brown, sometimes paler at the tip, and with a dark marginal line before them.

Beneath.—Paler than above. Primaries with the discal and subapical spots more distinct and an ill-defined pale spot in interspace 1 under the spot in interspace 2; base of wing below the costa black, costal margin and apical area with fulvous-brown overscaling, the stigma faintly outlined. Secondaries with tan, or rusty brown, and whitish overscaling. The discal band of pale spots is curved, ill-defined, and varies in distinctness; when well represented it consists of seven spots between veins 1*b* and 8 and a spot in the end of the cell. The dark marginal line before the fringes is present on both wings. The fringes are much the same as on the upper side, and sometimes are spotted with dark brown at the end of the veins.

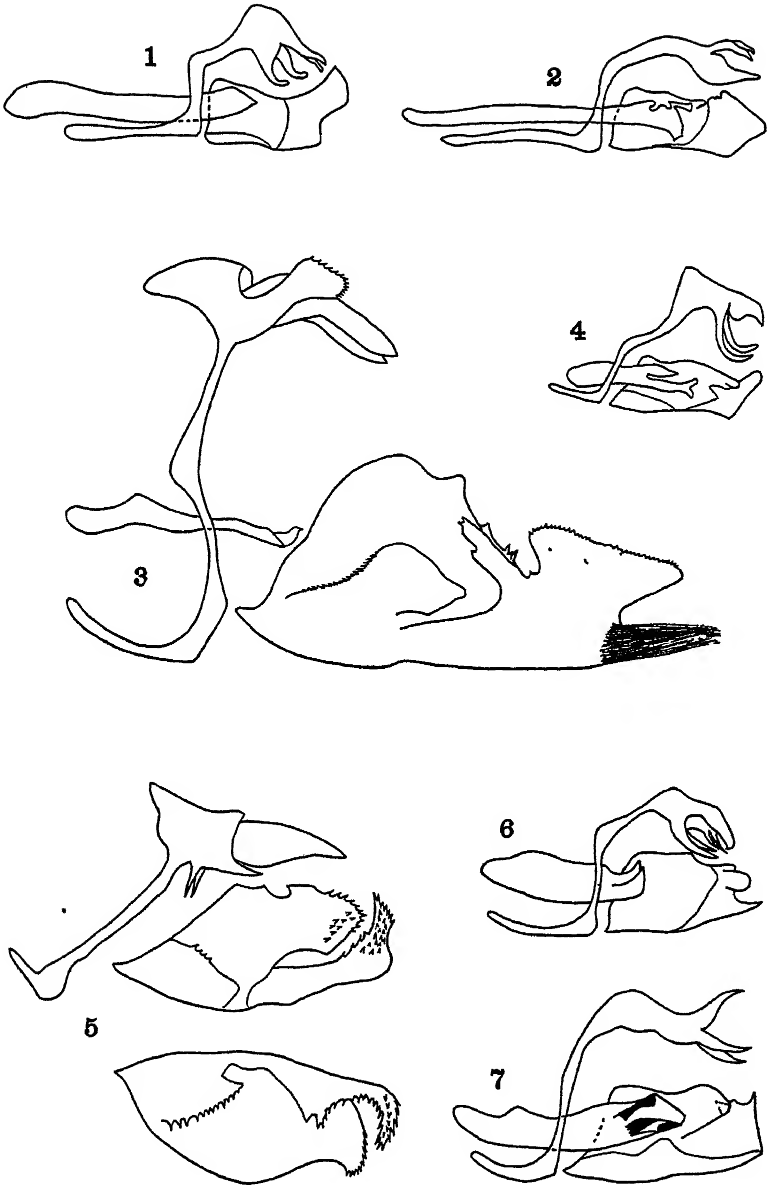
Body blackish above, with olive-brown hairs. Thorax grayish beneath, abdomen varying from pale brown to yellowish gray. Legs brown. Head brown or olive-brown, intermixed with grayish hairs. Palpi beneath and pectus grayish or pale yellowish. Antennæ black above, pale yellowish beneath, the club red.

Female.—Similar to the male, the spots of the primaries and sometimes those of the secondaries more distinct. Sometimes there is an additional small spot in the lower part of the cell near the end. There is, of course, no stigma on the primaries.

Expanse.—Male, 28–32 mm.; female, 30–34 mm.

Types.—Holotype, male, Arabupu, Brazil, January 2, 1928; allotype, female, Villa Rica, Paraguay, May; in collection of The American Museum of Natural History. Paratypes: five males, one female, Coroico, Bolivia; two males, Buenavista, 75 km. southwest of Santa Cruz, Bolivia; one female, Chapada, Matto Grosso, Brazil; eight males, two females, Villa Rica, Paraguay; five males, three females, Sapucay, Paraguay, in collection of The Academy of Natural Sciences, Philadelphia, Pa.; one male, St. Laurent, French Guiana; two males, Santa Cruz, Bolivia; four males, two females, Villa Rica, Paraguay; three males, two females, Massaranduba, Blumenau, Santa Catharina, Brazil, in collection of the author.

Named for Dr. A. W. Lindsey, who has contributed so much to the knowledge of the Hesperiidæ.



Male genitalia.

Fig. 1. *Mnestheus roraimæ*, new species. Fig. 4. *Eutocus arabupuana*, new species.
Fig. 2. *Thespius duidensis*, new species. Fig. 5. *Eracon (?) duidæ*, new species.
Fig. 3. *Yanguna tatei*, new species. Fig. 6. *Eutocus paulo*, new species.
Fig. 7. *Chærephon lindseyi*, new species.

This species somewhat resembles *Chærephon citrus* Mabille, differing from it in the much less developed and not so distinctly yellow maculation of the upper side of the wings and in the less contrastive appearance of the under side. The form of the genitalia is somewhat similar in the two species but constantly differs in slight details.

This is the species to which Dr. Lindsey referred in his paper as *Chærephon pudorina* Plötz (1925, Denison University Bulletin, Journal of the Scientific Laboratories, XXI (March), p. 92, Pl. xxvi, fig. 10, Pl. xxx, fig. 11. Scientific Results. No. II. Hesperioidea. The Cornell University Entomological Expedition to South America of 1919–1920). The Plötz species is a member of the genus *Catia.*

Lindseyi also resembles, on the upper side, the figure of "*Pamphila*" *mengeli* Weeks (1911, 'Illustrations of Diurnal Lepidoptera,' II, Pl. xi, fig. I), but it does not entirely agree with the text of the description on page 17 of that publication. Dr. D. M. Bates compared a specimen sent to the Museum of Comparative Zoölogy, Cambridge, Mass., with the type of *mengeli*, but it differed from the type in so many points that it does not seem probable that they are conspecific, one of the principal differences being the prominently paler veins on the under side of the secondaries of *mengeli*, as noted in the description.

Only the holotype male was taken by Mr. Tate; the allotype female was taken from the collection of the author; and the paratypes have long stood unidentified in the collections noted.

Prenes fusina Hewitson

Arabupu, Brazil, December 26, 1927, 1 ♂.

Euroto saramacca Williams and Bell

Paulo, Brazil, November 5, 1927, 1 ♂.

There are specimens in the collection of the author, from Surinam, British Guiana, Peru, and Trinidad.

Euroto (?) species

Anundabaru, British Guiana, January, 1928, 1 ♀.

This female remains unidentified and may not belong in this genus, but it is provisionally placed here because of its general appearance.

Papias phæomelas Hübner

Arabupu, Brazil, November 26, 1927, 1 ♀.

Rondon Camp, Mt. Roraima, Brazil, December 3, 1927, 1 ♂.

Recorded from Mexico to Brazil.

Eutocus arabupuana, new species

Figure 4

MALE.—Upper side dark brown. Primaries with a few scattered, yellowish scales along the costa. The stigma is a small, indistinct, blackish patch in the angle at the rise of vein 2.

Beneath.—A little paler than above. Primaries with a pale stripe along the inner margin, lightly over caled with yellowish on the costal margin and at the apex; two darker brown spots extend across the cell a little beyond the center; three bands of dark brown spots extend beyond the cell-end, the first two slightly curved and stopping on vein 3, the outer one submarginal and stopping just below vein 2; a similarly colored terminal line stops on vein 1. Secondaries lightly overscaled with yellowish. There are five transverse, sinuous bands composed of darker brown spots. Between the second and third band from the base of the wing are some similarly colored spots in the costal area, and there is a prominent dark brown terminal line.

Fringes slightly paler than the ground color. Body, above, brownish with some paler brown hairs; beneath, dark grayish, the abdomen somewhat paler with a central line of brown spots. Legs brown, striped with grayish. Head brown, with some fulvous hairs. Pectus grayish. The palpi are missing, but from the remaining scales at the base it seems probable that they were grayish. Antennæ brown above; beneath, a little paler at the joints, the apiculus grayish.

Expanse.—24 mm.

TYPES.—Holotype, male, and one male paratype, Arabupu, Brazil, December 26, 1927, in collection of The American Museum of Natural History.

This species is smaller than *Eutocus phthia* Godman and differs from it in the paler ground color and the sinuous bands on the under side of the secondaries.

Eutocus paulo, new species

Figure 6

MALE.—Upper side light brown with a more or less fulvous sheen. Primaries on the costal margin lightly overscaled with fulvous from the base to the apex; a discal, transverse stripe of similarly colored, scattered scales extends around the end of the cell and accumulates as hazy spots in interspaces 2 and 3. The stigma is a small, inconspicuous, subtriangular patch filling the angle at the rise of vein 2. Secondaries in the discal area and along the abdominal fold with longer fulvous-brown hairs and a few scattered fulvous scales in the discal area. Fringes brown, slightly paler at the tip of the secondaries.

Beneath.—Paler than above. Primaries above vein 2 overscaled with fulvous brown, the two hazy spots of the upper side a little more distinct but ill-defined; below vein 2 the overscaling is absent and makes this area seem paler than the rest of the wing. There is a narrow, irregular brown line just beyond the cell-end, followed by a similar brown line from near the apex to vein 2, the space between these two lines appearing as a band of light brown spots in the apical area. There is a narrow, brown terminal line before the fringes. Secondaries with a small, brown transverse line in the cell-end, three wavy brown lines composed of slightly lunate spots in the inter-

spaces between veins 2 and 7, and a brown terminal line before the fringes which are a little paler than above.

Thorax and abdomen, above, brown with long fulvous-brown hairs at the base of the thorax and some similarly colored scales on the abdomen. Beneath, the thorax is gray, and the abdomen whitish with a brown central stripe. Head with black and fulvous-brown hairs. Tegulæ fulvous brown. Palpi, beneath, whitish and fulvous brown, the last joint black above and grayish beneath. Pectus grayish. Most of the legs are missing but those present are brown. Antennæ black above; beneath, yellowish between the joints, the club yellowish.

Expanse.—32 mm.

Holotype.—Male, Paulo, Brazil, November 5, 1927, in collection of The American Museum of Natural History.

The form of the genitalia is quite similar to that of *Eutocus phthia* Godman, from which it differs superficially in being much larger and paler in color and the maculation of the under side being entirely different. It is larger but with different maculation than either *E. ranesus* Schaus or *E. illepidus* Bell, and differs in the same manner from *E. schmithi* Bell, although approaching it in size.

Mnestheus roraimæ, new species

Figure 1

Male.—Upper side. Primaries blackish brown. A transverse discal band of five fulvous spots. The lowest in interspace 1, constricted in the center;. a subquadrate one in interspace 2; a sub-triangular one in interspace 3; an oblong one in interspace 4; a small, narrow dash just above vein 5; two similarly colored subapical spots in interspaces 6 and 7; basal two-thirds of the costal margin fulvous. The stigma is a short, indistinct stripe along the median vein to the angle of vein 2 and a small longitudinal stripe just below that vein. Secondaries with a large fulvous discal area which is continued along the veins toward the outer margin, producing a dentate appearance; costal area broadly brownish black, outer margin and abdominal fold brownish black. Between the fulvous discal area and the abdominal fold there are brownish-fulvous hairs.

Beneath.—Primaries with the upper half of the cell, costal margin, and apical area overscaled with fulvous; the rest of the wing is black. The veins in the apical area are paler; the discal spots in interspaces 2, 3, and 4 and the two subapical spots are repeated. Secondaries brownish fulvous with paler veins.

Thorax, above, with greenish-fulvous hairs; basal half of the abdomen blackish brown, anal half fulvous. Beneath, the thorax has fulvous hairs, abdomen whitish, the side fulvous. Legs brown with fulvous hairs. Head black and fulvous. Palpi missing but probably yellowish or fulvous. Pectus grayish fulvous. Antennæ black above; beneath, spotted with fulvous at the joints, the club fulvous. The fringes are nearly worn off, but those of the primaries appear to have been concolorous, and a few scales left at the anal angle of the secondaries are fulvous, above which there are remnants of whitish scales.

Expanse.—28 mm.

HOLOTYPE.—Male, Arabupu, Brazil, December 26, 1927, in collection of The American Museum of Natural History.

This species superficially resembles *Padraona epictetus* Fabricius and *Padraona eudesmia* Plötz, but the presence of the stigma easily separates it from either. It differs from the other species of *Mnestheus* in the much broader discal band of the primaries and fulvous discal area of the secondaries.

TYLER DUIDA EXPEDITION

BRAZIL

Barcellos, Rio Negro.—This and the following Rio Negro localities are below three hundred feet altitude and in tropical forest.

Santa Yzabel, Rio Negro.

Caiari-Uaupes, mouth of the Rio Uaupes.

São Gabriel, Rio Negro.

Yucabi, Rio Negro.

Rio Negro.

São Carlos, Rio Negro.

VENEZUELA

Esmeralda.—On the Orinoco, 325 feet altitude. Open savannas.

Grand Savana, Mt. Duida.—At the foot of the mountain, 325 feet altitude.

Middle Camp, Mt. Duida.—At the foot of the mountain, 325 feet altitude.

Base River Playa, Mt. Duida.—At the foot of the mountain, in the forest, 350 feet altitude.

Foothills Camp, Mt. Duida.—At the foot of the mountain, in the forest 800 feet altitude.

Savana Hills Camp, Mt. Duida.—Summit of the mountain, 4500 feet altitude.

Provisional Camp, Mt. Duida.—On the summit of the mountain, crest of ridge No. 23, 6000 feet altitude.

Pyrrhopyginæ

Mysoria acastus Cramer

Barcellos, Brazil, September 5, 1928, 1 ♂.

It seems rather remarkable that the only two specimens taken, including the one from Paulo, Brazil, on the Mt. Roraima expedition, should be representative of the

typical insect, which seems generally to be rather less common than the form *M. venezuelæ* Scudder. The orange marginal band on the under side of the secondaries is less broad in this specimen than in the one from Paulo, but this character seems to be variable.

Mysoria thasus Cramer

Esmeralda, Venezuela, October 29, 1928, 1 ♂.

Occurs also in Surinam, Colombia, Ecuador, Bolivia, and northern Brazil.

Yanguna tatei, new species

Figure 3

MALE.—Upper side black, with a bright green sheen. Primaries with a transverse, semi-hyaline discal band of three orange-red spots, the upper one quadrate and extending across the cell, the next one a little longer than wide and extending across interspace 2, the lowest one narrower than the other two and extending across interspace 1. The veins of the secondaries in the outer two-thirds are paler green.

Beneath.—Primaries paler than above, becoming pale brownish toward the base, the discal band repeated but paler in color, the lowest spot paler than the other two. Secondaries with a brilliant green sheen, the veins not paler green as above.

The fringes of the primaries are practically worn off, but from the remaining scales they appear to have been white, except perhaps at the apex; the fringes of the secondaries are white. Body above and beneath shining greenish black. Legs greenish black, fringed with long greenish-black hairs. Tegulæ greenish black. Shoulder-covers greenish black with a large red spot on each side. Collar red. Head black with a large red spot behind the antennæ. Palpi red, the tips brown. Cheeks red. Pectus greenish black. Anal tuft red. Antennæ black.

Expanse.—58 mm.

HOLOTYPE.—Male, Mt. Duida (Provisional Camp), Venezuela, December 12, 1928, in collection of The American Museum of Natural History.

Named for Mr. G. H. H. Tate, who collected the specimen on the summit of Mt. Duida.

Mr. Tate states that the specimen was found basking in the sunshine. This seems to be a characteristic trait of such Pyrrhopyginæ as the writer has observed in the field. This species has much the same wing shape as *Yanguna staudingeri* Plötz, it but differs conspicuously from it and the other allied species in having an orange-red discal band on the primaries instead of white. There are, of course, other differences, but the orange-red discal band is an outstanding character.

Jemadia zonara Hewitson

Esmeralda, Venezuela, October 31, 1928, 1 ♂.

Also occurs in Colombia and the upper Amazons of Brazil.

Pyrginæ

Goniurus simplicius Stoll

Mt. Duida (Grand Savana), Venezuela, November 3, 1928, 1 ♂.

Widely distributed and usually common, flying with *Goniurus eurycles* Latreille with which it is often confused. Recorded from southern Texas and Arizona, through Central and South America to southern Brazil and Paraguay, and in Trinidad.

Goniurus eurycles Latreille

Esmeralda, Venezuela, October 27, 1928. 1 ♂

Goniurus dorantes Stoll

Santa Yzabel, Brazil, September 8, 1928, 1 ♂.

Caiari-Uaupes, Brazil, September 18, 1928, 1 ♂.

Widely distributed and common. Recorded from Texas and Arizona to Argentine and in races from Lower California, Antilles, and Galapagos Islands.

Proteides mercurius Fabricius

Esmeralda, Venezuela, October 14, 1928, 1 ♂.

Widely distributed. Recorded from Texas, New Mexico and Arizona to southern Brazil and Paraguay. Also occurs in races in the Antilles.

Telemiades (?) species

Mt. Duida (Base River Playa), Venezuela, 1 ♀.

This unidentified female is of similar appearance to *megallus* Mabille, but it is a little smaller and without subapical spots on the primaries, and the dark bands of the secondaries are more regular and even, especially on the under side, where the bluish-gray color at the anal angle is absent.

Hyalothyrus nitocris Cramer

Mt. Duida (Base River Playa), Venezuela, November 14, 1928, 1 ♀.
The writer also has specimens from French and British Guiana.

Sophista aristoteles Doubleday, Westwood and Hewitson

Mt. Duida (Foothills Camp), Venezuela, November 15, 1928, 1 ♂.
Occurs in the Rio Negro region.

Sophista calendris Hewitson

Mt. Duida (Base River Playa), Venezuela, November 14, 1928, 1 ♂. The writer also has specimens from French Guiana and Obidos, Brazil.

Eracon (?) **duidæ,** new species

Figure 5

MALE.—Upper side brown. Primaries with a prominent black spot near the end of the cell and another smaller one just below it in the angle of vein 2; a less distinct sub-basal blackish-brown band; an irregular blackish-brown band from the costal margin to the inner margin bent around the end of the cell; and an irregular sub-marginal blackish-brown band. Fringes concolorous. No costal fold. Secondaries darker basally, a sub-basal blackish-brown band forked in the cell, leaving a small, paler bar between the two forks, a discal blackish-brown band merging with the outer fork of the sub-basal band at the cell end, and a submarginal band of spots of similar color. Costal margin paler. Fringes concolorous, paler at the anal angle.

Beneath.—Paler than above; the maculation reduced. The primaries have the submarginal and discal bands of the same shape as above; a small blackish spot just outside the cell-end; the black spot of the upper side lying in the cell and the one below it present but very pale brown; the sub-basal band barely discernible. Secondaries with the blackish-brown bands of the upper side of the same form; the pale bar in the cell is followed by another pale spot toward the base of the wing; and there is a large, irregular blackish-brown spot at the anal angle.

Body and head, above, brown; thorax, beneath, grayish brown, the abdomen whitish with a brown central stripe. Palpi grayish beneath. Legs pale brownish. Antennæ blackish brown, the club, beneath, with some fulvous scales.

Expanse.—34 mm.

HOLOTYPE.—Male, Mt. Duida (Middle Camp), Venezuela, November 4, 1928, in collection of The American Museum of Natural History.

It is difficult to assign this species to any of the described genera as it does not entirely agree with any of them. In the general wing-shape it resembles *Pellicia*, but it differs from that genus in lacking the hair-tuft on the costal margin of the upper side of the secondaries and the swollen veins in the costal area of the under side of those wings. It differs from the genus *Mycteris* in the same manner; from the genus *Nisoniades* in the broader and more pointed wings; and from the genus *Cyclosæmia* in the more elongate and less rounded secondaries. It differs also from the genus *Eracon* in the more pointed primaries and apparently lacks the hair-tuft of the hind tibiæ. There are no white dots in the black cell-spot of the primaries.

Pellicia macarius Herrich-Schäffer

Mt. Duida (Foothills Camp), Venezuela, November 24, 1928, 1 ♂. Taken on drying clothes.

Pellicia bessus Möschler

Mt. Duida (Foothills Camp), Venezuela, November 15, 24, 1928, 2 ♂.

The individual taken on the 24th also was found resting on drying clothes. These two specimens are very much of the same appearance as *P. macarius* Herrich-Schäffer, but the hair-tuft of the secondaries is considerably longer than in that species. They differ from *P. ephora* Herrich-Schäffer in the more rounded secondaries.

Potamanaxas violacea Dognin

Mt. Duida (Savana Hills Camp), Venezuela, February 2, 1929, 1 ♀.

This specimen is rather darker than specimens of the opposite sex in my collection and seems to be intermediate between the typical insect and the form *fumida* Draudt from the western Cordilleras of Colombia. The difference may be sexual, but this point cannot be determined at present as there are no females from the type locality for comparison.

Ebrietas anacreon Staudinger

Mt. Duida (Middle Camp), Venezuela, November 4, 1928, 2 ♂.

Extends from Mexico to south Brazil.

Ebrietas osyris Butler

São Gabriel, Brazil, September 18, 1928, 1 ♂.

Mt. Duida (Foothills Camp), Venezuela, November 19, 1928, 1 ♂.

Extends from Mexico to south Brazil.

Charidia lucaria Hewitson

Caiari-Uaupes, Brazil, September 19, 1928, 1 ♀.

Also found in Surinam, Colombia, Bolivia.

Heliopetes alana Reakirt

Mt. Duida (Foothills Camp), Venezuela, November 19, 1928, 1 ♂.

Recorded from Mexico to south Brazil and Paraguay.

Chiomara punctum Mabille

Esmeralda, Venezuela, October 27, 1928, 1 ♂, 1 ♀.

Mt. Duida (Middle Camp), Venezuela, November 4, 1928, 1 ♀.

Draudt, in Seitz, 'Macrolepidoptera of the World,' states that this species is widely distributed in South America. There are specimens in my collection from Surinam and Bolivia.

Hesperiinæ

Talides athenion Hübner

Yucabi, Brazil, September 12, 1928, 1 ♂.

An extremely common species, distributed from Mexico to southern Brazil.

Catia otho Abbot and Smith

Santa Yzabel, Brazil, September 8, 1928, 1 ♂.

Otho from Trinidad and South America differs in some respects from the typical form occurring in the southeastern United States. It is said to occur as far south as Brazil.

Atrytone (?) species

Mt. Duida (Savana Hills Camp), Venezuela, January 31, 1929, 1 ♀.

This unidentified female may not belong in this genus, but the general appearance and rather short antennæ seem at least to place it near it.

Paraides ocrinus Plötz

Rio Negro, Brazil, April, 1929, 1 ♀.

Recorded from Panama to Brazil.

Thespius duidensis, new species

Figure 2

MALE.—Upper side brown. All of the specimens are worn, but in the type and some of the others there are traces of bluish hairs in the basal area of the secondaries; in others these hairs are entirely absent. The primaries have eight white hyaline spots on each wing; one cellular, a little constricted in the center; four discal in an oblique line toward the apex, the lowest (small) on vein 1, and varying in shape among individuals, the next (the largest) irregular in shape and extending across interspace 2, the next (small) in interspace 3, the fourth (smallest) in interspace 4; three subapical spots in a straight line, the lowest one the smallest. The stigma is narrow, gray, and of the form characterising this genus. Secondaries with three white hyaline discal spots and a small one in the cell; the two lower discal spots are larger than the upper spot but the inner edge of all forms a continuous, straight line.

Beneath.—Primaries reddish brown, becoming paler brown in the basal area where a patch of black hairs is enclosed. Spots of the upper side repeated, that in interspace 1 a little larger than above and somewhat diffuse, a pale area below the apex, internally edged with whitish scales from the upper discal hyaline spot to the apex. Secondaries red-brown. A distinct but ill-defined white line from vein 1*b* to the costal margin crosses the basal third of the wing; a white stripe from the base through the center of the cell merges with this line near the end of the cell, thus forming a

sharp angle which encloses a triangular patch of dark reddish color. The three white hyaline discal spots and the cell-spot are repeated. The discal spots are surrounded by a narrow line of white scales. The cell-spot is enclosed at the point of mergence of the cellular white stripe and the transverse white line. A short, ill-defined white stripe extends from the lowest of the discal spots to vein 1*b*, and another from the upper spot extends obliquely to the margin of the wing at the upper angle. The outer margin of the wing below this stripe is paler. The white markings leave a broad, reddish, central area of the wing constricted at the cell-end.

Fringes of primaries concolorous; of secondaries a little paler, becoming whitish at the anal angle. Body black above, with brown and greenish hairs extending over the base of the abdomen. Thorax grayish beneath. Abdomen dark brownish-gray. Legs brown, fringed with reddish hairs, particularly prominent on the hind tibiæ, Head, shoulder-covers, and collar are red-brown. Palpi and pectus grayish with some red-brown hairs intermixed. Anal tuft blackish brown, sometimes with whitish hairs in the center. Antennæ brown above, the club over-scaled with whitish, the apiculus orange; beneath, with a white central line, the club and apiculus as above.

FEMALE.—Similar to the male. The wings are more rounded, the primaries less pointed at the apex. The primaries have an additional very small spot in the discal band, lying in interspace 5 and somewhat lunate in shape. Beneath, this spot lies in the line of white scales limiting the pale apical area and is practically indiscernible unless the specimen is held to the light. The outer marginal area of the secondaries, beneath, is paler and somewhat more hoary than in the male.

Expanse.—Male, 43–45 mm.; female, 46–48 mm.

TYPES.—Holotype, male, Mt. Duida (Provisional Camp), Venezuela, December 12, 1928; allotype female, same locality, December 10, 1928; one male and one female paratype, December 10, 1928, three male paratypes, December 12, 1928, all same locality, in collection of The American Museum of Natural History. One male paratype, same locality, December 12, 1928, in collection of the author.

This species bears a superficial resemblance to *Thespius macareus* Herrich-Schäffer from which it differs principally on the upper side in smaller spots of the discal band of the primaries and in this band being composed of four spots in the male instead of three as in *macareus;* in the secondaries having a cell-spot, absent in *macareus*; and in the upper spot of the discal band of these wings being small and not extending to the outer edge of the two lower spots. Beneath, the pattern of the maculation, while similar, differs in detail, and the two dark spots near the outer angle of the secondaries present in *macareus* are absent in *duidensis*.

Vehilius venosus Plotz

São Carlos, Brazil, September 24, 1928, 1 ♀.
Distributed from Panama to Brazil.

Cœliades fiscella Hewitson

Mt. Duida (Middle Camp), Venezuela, November 12, 1928, 1 ♀.
Distributed from Nicaragua to Brazil.

Eutocus species

Mt. Duida (Savana Hills Camp), Venezuela, January 31, 1929, 1 ♂, 1 ♀.

This insect may be the same as that described as *Eutocus paulo* on a previous page of this paper, but the ground color is a little darker in shade, especially on the under side, where the distinct wavy bands of the secondaries and the maculation in the apical area of the primaries is in part absent and the rest very much reduced; the palpi are also darker. As the male lacks the abdomen it is impossible to determine the exact relationship of the two insects. The stigma of the primaries of the male is of the form occurring in this genus: a small indistinct patch lying in the angle of the rise of vein 2.

The measurements of expanse given in the above descriptions represent twice the distance from the center of the thorax to the apex of one primary.

AMERICAN MUSEUM NOVITATES

Number 556 | Published by The American Museum of Natural History New York City | Sept. 12, 1932

59 57, 72 T (7)

NEW SPECIES OF TRYPANEIDÆ, WITH KEY TO THE NORTH AMERICAN GENERA

BY C. H. CURRAN

Several of the new species described in the following pages were contained in a collection of trypaneids forwarded for determination by Mr. S. C. Jones of Corvallis, Oregon. Mr. Jones has spent considerable time during the past few years studying the family from the economic aspect and as a result has secured excellent series of many species. The determination of the specimens has necessitated the examination of a great deal of undetermined material in the Museum Collection, has brought to light several undescribed forms from various parts of the United States, and has resulted in the identification of most of the species recorded from the Nearctic region.

In view of the fact that representatives of all but three of the known North American genera are represented in the Museum Collection a key for their separation is presented. Up to the present time the separation of genera has been based chiefly upon wing pattern, although Hendel has long since supplemented this with other characters, chiefly the arrangement of the bristles on the thorax. While it is true that many genera have a typical wing pattern by which they may be separated from related forms, it is obvious that such a basis for generic separation cannot be considered satisfactory and there has always been doubt concerning the proper disposition of many species. The presence or absence of setulæ on the third vein has been used to separate genera, but the character is apparently unsatisfactory and in many cases cannot be used for the separation of species within a genus, due to the great variation in the number and extent of the setulæ. The characters which I believe to be most satisfactory may be gleaned from a perusal of the key.

It will be noted that several generic names have been changed and some of the described species will naturally trace out to genera other than those in which they are now included. The union of *Tephritis* Latreille and *Euaresta* Loew is necessary and the latter name falls as a synonym. The two genera intergrade in wing pattern, a reduction of the brown color leading to *Tephritis*.

In this paper are numerous references to a revision of the Trypetidæ of northeastern America by Phillips, an excellent contribution despite the fact that two or three generic names have not been correctly applied and that unsatisfactory characters were used for the separation of the species in at least two of the genera. The illustrations prepared by Mrs. Phillips are excellent and make the determination of the included species a relatively simple matter. It is unfortunate that Coquillett, who described so many of our species, failed to illustrate any of them, and they are, as a result, very difficult to identify. In a future publication the author proposes to illustrate the North American genera and would appreciate specimens of genera not included in the following key, or any specimens which do not trace out satisfactorily.

The types of the new species described in this paper are in The American Museum of Natural History.

Key to Genera

1.—Scutellum with six bristles..........................2.
Scutellum with not more than two pairs of bristles..........4.
2.—Front more than half as wide as the head................Xenochæta Snow.
Front decidedly less than half as wide as the head..........3.
3.—Triangle of the anal cell longer than the petiole......Blepharoneura Loew.
Triangle of the anal cell shorter than the petiole........Hexachæta Loew.
4.—Scutellum with two pairs of bristles, the apical pair strong...............13.
Scutellum with one pair of strong bristles, or, if with two pairs, the apical pair is absent and there are two pairs on the basal half..................5.
5.—Frontal bristles well developed; ocellars present....................6.
Frontals weak; ocellars absent; ovipositor very long and cylindrical.
Toxotrypanea Gerstæcker.
6.—Head higher than long.................................7.
Head longer than high.....................Ensina Loew.
7.—Scutellum without a deep longitudinal furrow..................8.
Scutellum swollen and with a deep longitudinal furrow.....Peronyma Loew.
8.—Front immediately above the antennæ almost half as wide as the head and very much wider than either eye...............................9.
Front much less than half as wide as the head and, anteriorly, little if any wider than one eye from anterior view..........................10.
9.—Anterior pair of dorsocentrals situated far in front of a line drawn between the anterior pair of supra-alar bristles. (Type: *Trypeta latifrons* Loew.)
Eurostina, n. g.
Anterior pair of dorsocentrals situated at most slightly in front of a line drawn between the anterior supra-alars, or behind such a line. (Type: *Trypeta solidaginis* Fitch).................................Eurosta Loew.
10.—Front twice as long as the width at vertex..........Xanthaciura Hendel.
Front much less than twice as long as the width at vertex.................11.

11.—Front with at least three pairs of convergent frontal bristles..............12.
Front with two pairs of convergent frontals ....DYSEUARESTA Hendel.
12.—Head almost as long as high, the oral margin projecting; eyes oblique, broadly oval........................ ....TRYPANEA Schrank.
Head much higher than long, the oral margin but little projecting; eyes perpendicular, rather narrowly oval.................. ..ACIURINA, n. g.
13.—Fourth vein not or scarcely curved forward at the apex............. .....14.
Fourth vein strongly curved forward at the apex...... .ANASTREPHA Schiner.
14.—Anterior pair of dorsocentrals situated far in front of a line drawn between the anterior pair of supra-alars... ....28.
Anterior dorsocentrals situated at most slightly in front of such a line, usually behind... . ...15.
15.—Proboscis very long and slender, geniculate.... ....ALEOMYIA Phillips.
Proboscis short and thick, not geniculate in the middle...................16.
16.—Arista short plumose or bare. ....17.
Arista long plumose... ....MOLYNOCŒLIA Giglio-Tos.
17.—Scutellum not mostly shining black, or the apex yellow. ....18.
Scutellum mostly shining black, the base narrowly yellow. .CERATITIS McLeay.
18.—Acrostical and dorsocentral bristles in an almost transverse row.
TRYPETA MEIGEN.
Dorsocentrals placed far in front of acrosticals so that there appear to be two pairs of dorsocentrals....... .... .19.
19.—Notopleura with several setulæ near the posterior bristle....EPOCHRA Loew.
Notopleura bare..... ....20.
20.—Cheeks at most slightly more than one-fourth as wide as the eye-height.....21.
Cheeks at least two-fifths as wide as the eye-height; oral margin not strongly produced.... .... .27.
21.—Stigmatal cell long and narrow, four times as long as wide; wings reticulate.
ICTERICA Loew.
Stigmatal cell shorter and broader, not over three times as long as wide; wings not reticulate............... ....22.
22.—Notopleura densely pollinose. . ...26.
Notopleura not pollinose........................... ....23.
23.—Third antennal segment not longer than the basal two combined, never triangularly produced at the tip....................................25.
Third antennal segment elongate, usually produced as a sharp triangle at the upper apex...24.
24.—Occiput strongly swollen on the lower half, at the middle more than half as wide as the eye in profile..............................ZONOSEMA Loew.
Occiput less swollen, at the middle not half as wide as either eye.
RHAGOLETIS Loew.
25.—Face carinate, not concave in profile ....ACIDIA Loew.
Face concave in profile, the oral margin produced......TERELLIA Desvoidy.
26.—Wings half as wide as long, reticulate..................XANTHOMYIA Phillips.
Wings narrow, hyaline or fasciate................NEASPILOTA Osten Sacken.
27.—Fourth vein ending at or near the tip of the wing..........ŒDICARENA Snow.
Fourth vein ending behind the tip of the wing, the apex near the third vein; wings rather pointed.........................STRAUSSIA Desvoidy.

28.—Anterior and posterior cross-veins separated from each other by much less than half the length of the anterior cross-vein; posterior cross-vein very strongly recurrent.................................. POLYMORPHOMYIA Snow.
Cross-veins much less approximate.................................. 29.
29.—Scutellum strongly shining black, swollen and hemispherical.............. 30.
Scutellum more or less dull, more or less flattened or at most moderately convex.. 31.
30.—Parafacials bare.............................. PROCECIDOCHARES Hendel.
Parafacials with a row of rather long pale hairs.......... CALLACHNA Aldrich.
31.—Notopleura cinereous pollinose.................................. 32.
Notopleura bare or rather thinly brownish pollinose...................... 34.
32.—Anal cell drawn out posteriorly into an elongate triangle.................. 33.
Anal cell not drawn out apically or with a short, transverse triangle. (*Euaresta* Loew).. TEPHRITIS Latreille.
33.—Wing margin with radiating brown rays on the apex in front.
TETREUARESTA Hendel.
Wing margin brown in front of the fourth vein......... ACROTAENIA Loew.[1]
34.—Front very much wider than long.................... TOMOPLAGINA, n. g.
Front longer than wide.. 35.
35.—Anterior cross-vein situated not more than its own length from the posterior, both strongly oblique........................ TOMOPLAGIA Coquillett.
Anterior cross-vein situated more than its length from the posterior, both never strongly oblique.. 36.
36.—Stigmal cell scarcely longer than wide...................... STENOPA Loew.
Stigmal cell usually twice as long as wide, always much longer............. 37.
37.—Front with two pairs of black reclinate bristles, none converging.
PARACANTHA COQUILLETT.
Front with three pairs of convergent frontals............................ 38.
38.—Costal spines short and not very conspicuous.......................... 39.
Costal spines rather long and conspicuous.................. EUTRETA Loew.
39.—Wings with cross-bands............................ TERELLIA Desvoidy.
Wings with a brown pattern containing hyaline indentations and spots.
EUCOSMOPTERA PHILLIPS.

EUROSTINA, new genus

Differs from *Eurosta* Loew in having the anterior pair of dorsocentral bristles situated close to the suture. Front more than half as wide as the head; three pairs of convergent frontals; head higher than long; scutellum normally with a single pair of bristles, sometimes with two pairs but they are lateral, the apical pair of bristles always absent; wings broad, brown, reticulate, the apex with brown rays; anal cell not drawn out into a long triangle.

GENOTYPE.—*Trypeta latifrons* Loew.

EUROSTA Loew

Similar to *Eurostina*, new genus, except in regard to the position of

[1]No specimens are available but the genus seems to be distinct from the later *Tetreuaresta* Hendel.

the anterior pair of dorsocentrals, which are, in this genus, situated almost in a line with the anterior supra-alar bristles, or behind a line drawn between these bristles.

Phillips separates the species by the number of scutellar bristles. The normal number is two, but they vary from two to six and there may be two or three on one side and fewer on the other. *Eurosta* belongs in a group of genera possessing, typically, a single pair of scutellar bristles, the apical bristles being absent. When more than a single pair of bristles occur they are lateral and situated on the basal half of the scutellum, as measured along the sides. The scutellum is transverse.

Trypanea Schrank

This name replaces *Urellia* Loew and applies to a group of species having a rather characteristic wing pattern and possessing only a single pair of bristles on the scutellum. The determination of the species is rather difficult as no key is available and Coquillett's comparisons with supposedly related species are very misleading. The Museum Collection contains all but four of the described North American species, lacking *dacetoptera* Phillips, *eugenia* Wulp, *nigricornis* Coquillett, and *vicina* Wulp. Inasmuch as all but *nigricornis* are figured, and as this species is easily recognizable by the color of the antennæ, I am able to present a table of species which will, it is hoped, prove satisfactory. *T.* (*Trypeta*) *femoralis* Thomson, described from California, is omitted, as the species is unrecognizable from the description. *T. stigmatica* Coquillett must be removed from the genus because of the presence of two pairs of strong scutellar bristles.

The amount of variation in the wing maculation is not great, although in one or two of the species variation is evident, especially as regards the presence or absence of a second brown ray in the discal cell. In *wheeleri* there is sometimes a second ray, but it is normally absent.

Table of Species

1.—No brown or gray spot near the middle of the fifth vein.................9.
A small gray spot behind the middle of the discal cell or the fifth vein bordered with deep brown for part of its length.................................2.

2.—No brown rays extending over the apices of the third and fourth veins, the apex of the wing entirely hyaline.......................................3.
Apex of the wing with brown rays extending along the third and fourth veins..4.

3.—No brown ray extending to the stigma, the stigmal cell wholly pale yellowish. *radifera* Coquillett.
A brown ray extends to and crosses the stigmal cell... *imperfecta* Coquillett.

4.—A small, roundish gray or pale brown spot near the middle of the fifth vein....5.
An elongate deep brown spot bordering the fifth vein....................6.
5.—A tranverse oval hyaline spot just beyond the anterior cross-vein.
actinobola Loew.
Base of apical cell brown (Mexico)..........................*vicina* Wulp.
6.—Stigmal cell not wholly hyaline or very pale yellowish.....................7.
Stigmal cell entirely pale................ ....*hebes*, n. sp.
7.—Stigmal cell brown on its full width.. ... .8.
Stigmal cell with an isolated brown spot basally on the anterior half.
microstigma, n. sp.
8.—Apical cell with a transverse, hyaline basal spot, the first basal cell wholly hyaline... ....*jonesi*, n. sp.
Apical cell brown basally, the first basal with the apex brown .*wheeleri*, n. sp.
9.—Basal half of the wing with many pale brown markings..... ..*abstersa* Loew.
Basal half of the wing without brown markings...... ....10.
10.—The brown band extending across the apical fourth of the discal cell continues to the wing margin... ....*eugenia* Wulp.
This band is absent or does not extend to the wing margin...... ....11.
11.—Two brown bands in the apical half of the discal cell... ... ...12.
Only one brown band in the discal cell..... ....13.
12.—Apex of first basal cell brown........ ....*dacetoptera* Phillips.
First basal cell wholly hyaline..... . ...*polyclona* Loew.
13.—Third antennal segment reddish... ....14.
Third antennal segment black...... ....*nigricornis* Coquillett.
14.—First anterior brown ray very wide on its whole length and almost filling the stigmal cell...................................*bisetosa* Coquillett.
First anterior ray narrow, crossing the stigmal cell (*mevarna* Walker).
daphne Wiedemann.

Trypanea jonesi, new species

Figure 6

Typically six brown rays on the apical and posterior parts of the wing. Length, 3 to 3.5 mm.

Female.—Head brownish yellow, with cinereous pollen, the front sometimes quite ashy in color. Front wide, very slightly narrowing anteriorly, with three pairs of convergent and one pair of reclinate black bristles. Oral margin produced, the head higher than long; cheeks narrow; occiput mostly brown in ground color, the hair whitish. Antennæ reddish, the third segment sometimes rather brown apically, subangulate at upper apical corner; arista brown.

Thorax blackish in ground color, densely cinereous pollinose, the hair whitish, yellow on the pleura; humeri yellow in ground color. Bristles of the dorsum black, the others brownish.

Legs reddish, the posterior four coxæ brown; hair mostly black, the bristles yellowish.

Wings whitish hyaline, with brown markings as shown in the figure. Halteres reddish or dull orange.

Abdomen black, cinereous pollinose, partly subshining gray, the ovipositor shining black. Hair yellow, short and appressed; black on the apical half of the ovipositor. Venter cinereous.

TYPES.—Holotype, female, Corvallis, Oregon, August 19, 1931 (S. C. Jones), reared from *Aster douglasii*. Paratypes: three females, Corvallis, August 11, 24 and 28, 1931, from the same host; three females, Crater Lake, Oregon, South rim, 7100 ft., July 29, 1930 (H. A. Scullen); female, Crater Lake Park, Dutton Ridge, Oregon, August 11, 1930 (H. A. Scullen); female, Jackson's Lake, Wyoming, September 16, 1895 (W. M. Wheeler).

This species is most nearly related to *actinobola* Loew but may be at once distinguished by the elongate brown spot bordering the fifth vein, the much more extensively brown stigma, more shining abdomen, distinctly shorter head, etc.

Trypanea wheeleri, new species

Figure 1

Similar to *jonesi*, new species, but the brown color extends to well inside the anterior cross-vein. Length, about 3.25 mm.

FEMALE.—Head reddish, the pollen whitish; upper half of the occiput black in ground color. Front wide, narrowing anteriorly; three pairs of convergent and one pair of reclinate frontals, strong ocellars and the vertical bristles black, the occipital cilia whitish. Occipital hair yellowish, sides of oral margin with very short black hairs on the anterior third. Proboscis reddish; palpi reddish, with pale base. Antennæ reddish, the second segment with very short black hair; arista brown. Head one-fourth higher than long, the oral margin projecting; third antennal segment obtuse at upper apex.

Thorax black in ground color, cinereous pollinose, the humeri and notopleura reddish; hair pale yellowish; dorsal bristles black, a bristle on the mesopleura and the sternopleural brown; notopleural bristle pale yellowish.

Legs reddish, the hair mostly brown, the bristles yellowish.

Wings whitish hyaline, with brown pattern as shown in the figure. There is, in two specimens, an additional brown ray extending from the posterior end of the anterior cross-vein to the apex of the brown cloud lying along the fifth vein and this seventh ray may be produced, within the discal cell, toward the sixth ray.

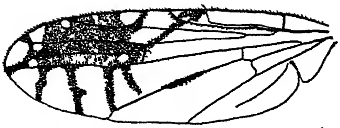
Abdomen black in ground color, rather thinly cinereous pollinose; hair yellow, rather abundant and longer than usual. Ovipositor shining black, with black hair on the apical half, a little more than half as wide as long.

TYPES.—Eight females, holotype and paratypes, San Diego Co., California, February 23, 1897 (W. M. Wheeler Collection).

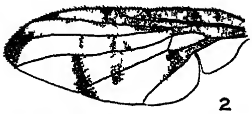
Trypanea microstigma, new species

Figure 8

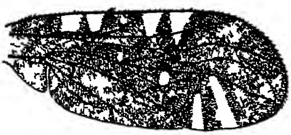
Distinguished by the very small, brown stigmal spot and the brown stripe lying along the fifth vein. Length, 3.5 mm.



1



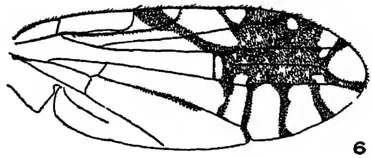
2



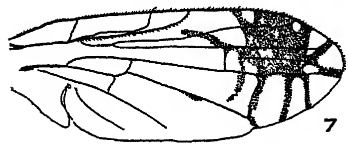
3

4

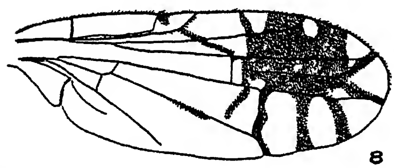
5



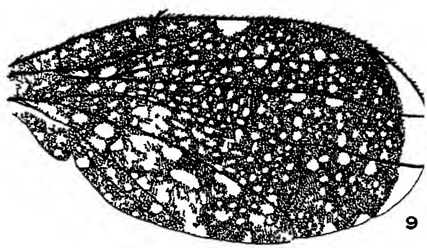
6



7



8



9

Fig. 1. *Trypanea wheeleri*, n. sp.
Fig. 2. *Trypeta versatilis*, n. sp.
Fig. 3. *Aciurina thoracica*, n. sp.
Fig. 4. *Aciurina pacifica*, n. sp.
Fig. 5. *Aciurina trixa*, n. sp.

Fig. 6. *Trypanea jonesi*, n. sp.
Fig. 7. *Trypanea hebes*, n. sp.
Fig. 8. *Trypanea microstigma*, n. sp.
Fig. 9. *Eutreta pacifica*, n. sp.

FEMALE.—Head reddish yellow, with cinereous-yellow pollen, the cheeks paler; occiput with a rectangular black spot above the neck. Front wide, narrowing anteriorly; three pairs of convergent and one pair of reclinate frontals (a second pair of whitish reclinate bristles), the ocellar and vertical bristles blackish. Occipital cilia whitish. Occiput and cheeks with pale yellowish hair. Proboscis reddish, ferruginous below; palpi yellow. Antennæ reddish; hair black; arista brown. Head one-eighth higher than long, the oral margin produced.

Thorax black in ground color, cinereous pollinose, the humeri and notopleura yellow. Hair pale yellowish, the bristles of the dorsum black, although one on the notopleura may be yellow; sternopleural bristle yellow or black.

Legs reddish, the hair mostly pale yellow.

Wings whitish hyaline, with brown pattern as shown in the figure, the brown stigmal spot small and isolated.

Abdomen black in ground color, cinereous pollinose, the hair pale brassy yellow; ovipositor shining black, about three-fourths as wide as long, with black hair on the apical half.

TYPES.—Holotype, female and paratype, female, Crater Lake, Oregon, south rim, 7100 ft., July 29, 1930 (H. A. Scullen).

Trypanea hebes, new species

Figure 7

Readily distinguished by the total absence of a black stigmal spot and the presence of a deep brown spot behind the fifth vein. Length, 3 mm.

FEMALE.—Head reddish yellow, the occiput mostly black above the neck; upper half of the front, and the occiput mostly, honey yellow. Front wide, narrowing anteriorly; bristles brown; three pairs of convergent and one pair of reclinate frontals; ocellars long; the bristle behind the upper reclinate and the postocellars whitish. Occipital cilia and hair yellowish white. Cheeks moderately wide, the hair yellowish; face pale pollinose, the oral margin produced. Proboscis reddish; palpi reddish yellow. Antennæ reddish, the hair yellow; arista brown on the apical half.

Thorax black in ground color, thickly cinereous-white pollinose, the humeri and a broad stripe extending along the upper border of the pleura from in front of, and including, the notopleura, to behind the base of the wings, pale yellowish. Hair yellowish white; bristles brownish yellow.

Legs reddish yellow, the hair and most of the bristles pale yellowish.

Wings hyaline, with whitish tinge in some lights, the brown pattern as in the figure. Stigmal cell very pale yellowish. Squamæ cinereous, with brown border, the fringe pale. Halteres pale yellow.

Abdominal hair very pale yellowish; ovipositor almost twice as long as wide. Abdomen cinereous pollinose.

TYPES.—Holotype, female, Buck Creek, Wyoming, August 14, 1895 (Wheeler). Paratypes: one female, Buck Creek (Wheeler), and female, Gallatin Co., Montana, June 29, 1920 (A. L. Strand).

ACIURINA, new genus

Related to *Xanthacuira* Hendel but differing in having the front very much less

than twice as long as its width at the vertex. Scutellum with one pair of bristles; head short, one-third, or more, higher than long; scutellum very gently convex, not grooved; front anteriorly less than half as wide as the head; much longer than wide, bearing three pairs of convergent frontals; occipital cilia whitish.

GENOTYPE.—*Aciurina trixa*, new species.

This genus actually comes nearest to *Trypanea* Schrank, despite the mostly brown wings, but like *Aciura, Xanthaciura,* and *Dyseuaresta* the head of *Trypanea* is only a little higher than long. I know of only two species of *Xanthaciura: chrysura* Thomson and *insecta* Loew. Hendel, has shown that *Aciura* does not occur in America and it is obvious that the American species do not belong together despite similar wing pattern. All the species with two pairs of scutellars belong to *Tetraciura* Hendel, while the others are divided between *Xanthaciura* and *Aciurina.*

I have seen only three species belonging to *Aciurina* and all are undescribed. However, it appears certain from the descriptions that most of the Nearctic species belong in this genus and I have prepared a key for their separation.

TABLE OF SPECIES

1.—Legs yellow, the anterior femora sometimes partly black. ... .4.
All the femora at least broadly black basally........ ....2.
2.—An inverted V-shaped hyaline spot in the second posterior cell, the arms separated by a brown triangle........................ *maculata* Cole.
A triangular hyaline spot in the second posterior cell............ ....3.
3.—Wings brown basally .. ..*pacifica*, n. sp.
Wings hyaline before the base of the discal cell.......... .. *opaca* Coquilett.
4.—Scutellum partly or wholly yellowish.................................. ....5.
Scutellum black or brown.... ....*aplopappi* Coquilett.
5.—Thorax and abdomen shining yellowish.. . ...*lutea* Coquillett.
Thorax opaque or black..6.
6.—Apical cell wholly brown.. .. ..7.
Apical cell with an oblique hyaline spot apically................*trixa*, n. sp.
7.—Third posterior cell with a round hyaline spot adjacent to the fifth vein. *ferruginea* Doane.
Third posterior cell without such spot............... ....*thoracica*, n. sp.

Aciurina pacifica, new species

Figure 4

Black, the abdomen shining red; head pale yellow. Length, 4.5 mm.

FEMALE.—Head pale yellow; occiput blackish in ground color except along the broad posterior orbits. Front wide, the sides converging anteriorly, the bristles black. Hair yellow; occipital cilia pale yellowish. Cheeks about one-sixth as wide as the eye-height. Proboscis, palpi and antennæ yellow, the arista mostly brown.

Thorax black, the scutellum obscurely reddish apically; hair very pale yellowish, only moderately abundant on the mesonotum; bristles black.

Coxæ, trochanters, and basal half or more of the femora black, the anterior four femora reddish on the under surface; apex of femora and the tibiæ and tarsi pale reddish yellow; hair and bristles black.

Wings brown, with whitish hyaline markings as shown in the figure. Squamæ cinereous hyaline. Knob of halteres brown.

Abdomen shining reddish, the immediate base, a broad, interrupted fascia on the dorsum of the fourth segment, the fifth segment and the ovipositor, shining black. Hair black, short and not conspicuous.

Type.—Female, Yakima, Washington, April 19, 1931 (W. W. Baker).

This species resembles *trixa* superficially but may be at once distinguished by the brown base of the wings, extensively black legs, more extensively black thorax with its less abundant pile, etc.

Aciurina trixa, new species

Figure 5

Black, the abdomen red; head pale yellow. Length, 4.5 mm.

Female.—Head pale yellow; hair and bristles pale yellow. Front wide, the sides convergent anteriorly. Cheeks one-fifth as wide as the eye-height. Palpi, proboscis, and antennæ yellow; third antennal segment not twice as long as wide, the upper apex obtuse; arista brown except basally.

Thorax black, the sides of the mesonotum in front of the wings, the anterior border of the pleura broadly, the pleural sutures and the apical half of the scutellum yellow. Hair and bristles pale yellowish, the appressed hair on the mesonotum abundant.

Legs yellow, with yellow hair and bristles.

Wings brown, with hyaline markings as shown in the figure, the base of the wings pale yellowish. Squamæ and halteres pale yellow.

Abdomen shining reddish, with sparse, pale yellowish hair. Ovipositor shining black, the preceding segment more or less black or brown dorsally.

Types.—Holotype, female, Stansbury Island, Utah, June 13, 1913 (Hagan Titus). Paratype, female, Collinston, Utah, July 21, 1927, on beets (G. F. Knowlton).

Aciurina thoracica, new species

Figure 3

Rusty reddish and yellowish, the mesonotum black in ground color. Length, 6 mm.

Female.—Head reddish yellow, clothed with yellowish pollen, occiput brown in ground color above the neck. Bristles black; hair yellow. Front wide, with parallel sides. Occipital cilia mixed whitish and black. Cheeks one-fifth as wide as the eye-height. Palpi yellowish, the proboscis reddish yellow. Antennæ reddish yellow; third segment not twice as long as wide, the upper apex subangular.

Thorax rusty yellowish; mesonotum black in ground color, the sides yellowish, covered with brownish-yellow pollen and abundant, appressed, pale yellowish hair,

the bristles brownish yellow. Pleura with sparse black hair, the bristles black. Scutellum reddish yellow, with a dark spot on either side toward the apex.

Legs rusty reddish yellow, the anterior femora darkened posteriorly; hair and bristles black.

Wings reddish brown, with hyaline areas as shown in the figure. Squamæ brownish gray. Halteres yellowish, the apex of the knob brown.

Abdomen rusty reddish, the second to fourth segments dorsally with broad ferruginous fasciæ which may be interrupted in the middle. Hair black, sparse. Ovipositor shining black, the basal third of the ventral surface reddish.

TYPE.—Female, San Diego Co., California (Wheeler Collection).

EUCOSMOPTERA Phillips

The three species occurring in the United States are separable as follows. The wings of all the species are figured by Phillips.[1]

TABLE OF SPECIES

1.—Thorax reddish yellow..2.
  Thorax black..*tetraspina* Phillips.
2.—Apical cell crossed by two hyaline triangles on the apical half.
  limata Coquillett.
  Apical cell containing a small, round, hyaline spot near the middle.
  nigricornis Doane.

ALEOMYIA Phillips

Since the publication of my key to the species belonging to this genus I have identified the two previously described species and now present a revised key. In the several specimens of *caurina* Doane there is a quite marked variation in the wing pattern and Doane's figure is from a poorly colored specimen. Two of my specimens agree with Doane's figure except that the subapical brown fascia is not interrupted.

REVISED TABLE OF SPECIES

1.—Thorax wholly yellow; oral margin very strongly produced; legs wholly yellowish..*alpha* Phillips.
  Mesonotum mostly black in ground color; oral margin moderately produced..2.
2.—Anterior coxæ yellow, the others brown; mesonotum very broadly reddish in front of the scutellum.................................*rufipes* Curran.
  All the coxæ black, the femora usually more or less black basally and sometimes posteriorly; mesonotum wholly black in ground color....*caurina* Doane.

Aleomyia alpha Phillips

PHILLIPS, 1923, Journ. N. Y. Ent. Soc., XXXI, p. 124 (f.).

One female from Valley of Black Mts., N. C., August 9, 1906 (W. Beutenmuller).

[1]1923, Journ. N. Y. Ent. Soc., XXXI, pp. 119–155.

Unlike the other two species, *alpha* is almost wholly rusty yellowish and has the face remarkably produced. The species is recorded from Maryland.

Aleomyia caurina Doane

Rhagoletis caurina Doane, 1899, Journ. N. Y. Ent. Soc., VII, p. 182.

Six females, Colorado Lake, Oregon, August 8–15, 1931, reared from *Grindelia nana* Nutt (S. C. Jones); three males and one female, San Diego Co., California, March 12, 14, 1897 (Wheeler Collection).

This species is easily recognized by its black coloration. The thorax is black except for a stramineous stripe extending from the humeri to the base of the wings. The scutellum is yellow with the lateral fourth to one-third shining black. In *rufipes* Curran the mesonotum and pleura bear extensive reddish-yellow markings.

Trypeta versatilis, new species

Figure 2

Rusty yellowish; mesonotum pollinose; abdomen shining and bearing four series of roundish black spots. Length, 4.5 to 5 mm.

Female.—Head whitish yellow, the front and upper half of the occiput sulphur-yellow. Front wide, narrowed anteriorly, with sparse black hair; three pairs of convergent frontals, one pair of reclinate frontals and above these a pair of weak, convergent bristles; ocellars short; postocellars strong; occipital cilia black and acute, hair of the occiput yellow. Cheeks narrow, the hair black. Face thinly white pollinose, the antennal grooves broad. Proboscis and palpi yellow. Antennæ yellow, very pale basally; hair black; arista bare, brown, the swollen base reddish.

Thorax rusty reddish, the mesonotum with similarly colored pollen, the hair and bristles black; a broad pale yellow stripe extends over the humeri, the upper border of the pleura and the scutellum, a similarly colored stripe above the wings and on the upper edge of the hypopleura; metanotum with a pair of black spots beneath the scutellum. Hair of propleura yellow. Dorsocentral bristles situated only a little in front of the acrosticals; scutellum with short black hair toward the sides.

Legs yellowish, the apical tarsal segment brownish; hair black; posterior tibiæ ciliate with short black bristles anterodorsally.

Wings hyaline, marked with yellow and brown as shown in the figure. Squamæ cinereous, the border and fringe pale brownish. Halteres pale yellow.

Abdomen shining rusty yellowish, on the dorsum with two series of roundish, moderately large, shining black spots, four in each row, and on either side with a series of three spots. Ovipositor rusty reddish, the apex broadly blackish, the base with a moderately large black spot on either side. Hair black. Venter reddish yellow, the hair yellow except apically.

Male.—Genitalia with a very large black spot on either side.

Types.—Holotype, female, Antelope Mt., Harney County, Oregon, 6500 ft.,

August 12, 1931; allotype, male, August 19 (D. K. Frewing). Paratypes: seven females, Antelope Mt., August 2, 3, 7, 10, 11, and 16, 1931 (D. K. Frewing).

As I do not have typical examples of *Trypeta* for examination I am not certain that this species belongs in the genus, although it must come close. The arrangement of the dorsocentral and acrostical bristles in an almost straight line is characteristic of this species, and the fact that the upper pair of frontals is convergent instead of reclinate is an important character. The third antennal segment is angular or rounded at the upper apex. The genus *Epochra* Loew bears only a single strong reclinate frontal bristle and is thereby distinguished from *Zonosema* Loew; these two genera have the dorsocentrals situated far in front of the acrosticals, so that it would appear that there are two pairs of dorsocentrals.

This species may be distinguished from the described species of *Trypeta* by the broad yellow costal border.

Tomoplagina, new genus

Differs from *Tomoplagia* Coquillett in having the front almost twice as wide as long and the anal cell oblique apically and not drawn out into a long point; three pairs of frontals, the upper pair reclinate; anterior pair of dorsocentrals situated close to the suture; scutellum with four bristles. Wing markings as in *Tomoplagia* but the yellowish-brown bands wider; costa broken at end of auxilliary vein; the subcostal vein oblique apically but weak; anal cell oblique apically. Ovipositor subcylindrical, elongate, much as in species of *Anastrepha* Schiner.

Genotype.—*Tomoplagina maculata*, new species.

While this genus agrees in wing markings with *Tomoplagia* the shape of the ovipositor and wide front indicate that it is closely related to *Anastrepha*.

Tomoplagina maculata, new species

Rusty reddish-yellow, with black spots. Length, about 5 mm.

Female.—Head twice as high as long, pale yellow, with whitish pollen; hair yellow, the bristles black. Front with three pairs of frontals, the upper pair reclinate; ocellars long and strong; each bristle arises from an opaque black spot. Occiput narrow; cheeks half as wide as the eye-height, higher than long, with a brown spot in front adjacent to one on the oral angles; face with a transverse opaque black spot on either side opposite the base of the antennæ. Proboscis, palpi and antennæ yellowish, the hair black; third antennal segment one-half longer than wide, the upper apical corner sharply rounded.

Mesonotum with yellowish pollen on the median half, the hair pale yellow and appressed; bristles black, each bristle arising from a black spot. Scutellum convex, the apex very shallowly longitudinally depressed, with a brown spot below on either side. Metanotum brownish.

Legs with black hair and bristles.

Wings pale yellowish-brown and hyaline, banded as in *Tomoplagia*,[1] the brown bands wider than the hyaline ones; auxiliary cell yellowish brown.

The abdominal bristles arise from deep black spots. Ovipositor rusty reddish, cylindrical, bearing black hair. The abdomen is damaged dorsally so I am unable to make out the details.

TYPE.—Female, Gotha, Florida, March, 1896 (Wheeler Collection).

EUTRETA Loew

This genus contains species in which the wing is brown with numerous small, more or less round, yellowish, cinereous or hyaline spots and the apex with a crescentric hyaline or whitish band. The spots sometimes tend to unite, especially in the discal and third posterior cell. The genus divides naturally into two groups: those with long black antennæ, represented by *longicornis* Snow and two additional species, and those with shorter, reddish-yellow antennæ. The second group may be again divided upon the presence of absence of dull black spots on the lower half of the face. In her treatment of the eastern trypaneids Mrs. Phillips separated the species upon the presence or absence of setulæ on the third longitudinal vein, but the character is valueless as the setulæ are present in all the species I have seen and the distance to which they extend along the vein varies in the same species.

As the Museum possesses examples of the Nearctic species, with the exception of *rotundipennis* Loew, I present a key for their separation.

TABLE OF SPECIES

1.—Face yellow, with two black spots below and usually other markings........2.
Face yellow, brown or black, usually pollinose..........................4.
2.—Front strongly narrowing anteriorly.. ....*frontalis*, n. sp.
Front not strongly narrowing anteriorly, of almost equal width.............3.
3.—Pale spots separated from the hyaline wing-tip by a very broad brown band. *sparsa* Wiedemann.
Pale spots separated from the hyaline wing-tip by a rather narrow impunctate band.............. ....*pacifica*, n. sp.
4.—Third antennal segment black........... ....5.
Antennæ yellow................................... ....7.
5.—Face shining black, without pollen. ....*longicornis* Snow.
Face brown or yellow, pollinose.... ....6.
6.—Face brown, pale pollinose... ....*facialis*, n. sp.
Face yellow in ground color.............................. *oregona*, n. sp.
7.—Pteropleura with yellow squamose hairs, the bristle sometimes black.......8.
Pteropleura with black hairs and bristles.....................*jonesi*, n. sp.

[1]See Phillips, 1923, Journ. N. Y. Ent. Soc., XXXI, Pl. XVIII, fig. 18.

8.—The hyaline apex of the wing is interrupted along the veins. .*rotundipennis* Loew.
The hyaline apex of the wing is not interrupted.......................... ......9.
9.—Abdomen brown, with yellow apex, distinctly pollinose; scutellum luteous in ground color; bristles mostly yellowish.. ....*pollinosa*, n. sp.
Abdomen brown or red and brown, sometimes almost all red; scutellum black. *diana* Osten Sacken.

Eutreta frontalis, new species

Front gradually narrowing from the vertex to the anterior margin; second antennal segment mostly yellow-haired above. Length, 5 to 6.5 mm.

FEMALE.—Head reddish yellow, the pollen whitish; posterior orbits broadly pale yellowish on the lower half; occiput reddish on the upper half, with a small brown spot near the middle of the posterior orbits. Front evenly narrowing anteriorly. Occipital cilia black and whitish, the pale bristles long. Face with a reddish-brown spot on either side of the anterior oral margin, a roundish black spot on either side of the lower part of the facial depression, and a small oblique black spot on the orbits opposite the base of the antennæ. Proboscis and palpi reddish yellow, the palpi with short, coarse, black hair. Antennæ reddish, the arista brown with pale base; second segment with mostly yellow hair.

Thorax rusty reddish, yellowish pollinose, the sides of the mesonotum with brownish-red pollen in front of the wings. Hair very pale yellowish, black on the sternum; bristles black.

Legs reddish, the hair mostly black; bristles black; anterior femora with a more or less evident blackish vitta posteriorly.

Wings as in *sparsa* Wiedemann[1] but more grayish brown in color, the apex white.

Abdomen rusty reddish or reddish yellow, the intermediate segments with paired, transverse, brownish spots basally, the spots sometimes forming interrupted fasciæ. Hair mostly black, the abdomen without conspicuous pollen. Ovipositor shining reddish, the apex broadly black or brown. Bristles black or brown.

MALE.—Second free segment of the abdomen and the two following brown, a median vitta and the posterior and lateral borders yellow; pollen cinereous yellow, quite obvious on the dark areas.

TYPES.—Holotype, female, valley of Black Mountains, North Carolina, August 5, 1906 (W. Beutenmuller); allotype, male, Black Mountains, N. C., June. Paratypes: male, Crugers, New York, July 3, 1912; male, Lackawaxen, Pennsylvania, August 22, 1895 (J. L. Zabriskie); male, Myrtle, Manitoba, August 13, 1928 (R. D. Bird); female, Hazelton, Pennsylvania, August 27, 1909 (Dietz); female, valley of Black Mountains, North Carolina, July 11, 1906 (W. Beutenmuller); female, Black Mountains, N. C., June.

This species is close to *sparsa* Wiedemann but is readily separated by the decidedly narrower front and narrower face. In *sparsa* the front is narrowed anteriorly, but much less so than in *frontalis*, and the hair on the second antennal segment is coarser and all black on the upper surface. The general coloration of *frontalis* is paler and there is no darker band extending over the middle of the pleura. In *sparsa* the short hair on the

[1]Phillips, 1925, Journ. N. Y. Ent. Soc., XXXI, Pl XIX, fig. 39

upper border of the mesopleura almost always has a salmon tinge, but it is pure white in *frontalis*.

Eutreta pacifica, new species

Figure 9

Related to *sparsa* Wiedemann but distinguished by having the pale wing spots separated from the hyaline apex by a very much narrower impunctate band, the presence of two hyaline spots along the posterior border of the wing beyond the fifth vein, and more grayish-brown color of the wings. Length, 5 mm.

MALE.—Head yellow, the front more reddish in the middle; upper half of the occiput brown. Front wide, the sides parallel on more than the upper half. Ocellars long. Occiput with cinereous white pollen, the occipital cilia mixed black and yellow. Cheeks yellow, with a brown spot in front narrowly separated from one on the oral margin. Face with a pair of large, dull black spots below the middle and a large one on either orbit opposite the antennæ. Proboscis reddish; palpi reddish yellow, the hair black and coarse. Antennæ reddish yellow; second segment with short black hair above; third segment angulate at upper apex, scarcely twice as long as wide. Arista brown, with yellow base.

Thorax rusty reddish in ground color, with cinereous-yellow pollen. Hair yellowish tinged; bristles brownish.

Legs reddish yellow; anterior femora obscurely brown posteriorly at the base; bristles black.

Wings grayish brown, with numerous yellowish hyaline spots as shown in the figure. Squamæ and halteres yellow.

Abdomen rusty reddish, the third and fourth segments more or less brownish; pollen rather yellowish.

TYPE.—Male, Pomona, California.

Eutreta facialis, new species

Related to *longicornis* Snow but the face is whitish pollinose instead of shining black. Length, 5 mm.

FEMALE.—Face brown, whitish pollinose, the oral margin narrowly pale yellow. Front pale dull yellow, the lunule and ocellar triangle brownish; orbits white pollinose; bristles brownish yellow. Occiput shining black, the orbits narrowly yellow; occipital cilia yellow, with short black bristles between the pale ones. Cheeks pale yellow. Proboscis reddish, brown below. Palpi yellow, becoming brown below on the apical half, with black, bristly hair in addition to fine pale hairs. Antennæ black, as long as the face, the third segment concave above; arista reddish basally.

Thorax shining black; very thinly whitish pollinose; scutellum brownish; humeri, notopleura and the pleura about the base of the wings brownish yellow. Hair very pale yellow; bristles brownish yellow, the pteropleural bristle white.

Coxæ and trochanters reddish; femora black, the bristles yellow; tibiæ reddish yellow, the anterior pair with the median half or more brownish; tarsi pale reddish yellow.

Wings brown, with numerous small, round, cinereous hyaline spots, those in the

discal and third posterior cells large, in the discal cell mostly more or less confluent; apex of the wing whitish hyaline. Squamæ cinereous white; halteres reddish yellow.

Abdomen blackish brown, the apical segment and middle and sides of the ovipositor dark reddish. Hair pale yellowish, black on the ovipositor.

TYPE.—Female, Huntley, Montana, July 19, 1919 (A. L. Strand).

Eutreta oregona, new species

Related to *longicornis* Snow but readily distinguished by the wholly yellow face. Length, 3 to 3.25 mm.

MALE.—Face pale yellow, the front more reddish yellow, with three black spots above, one on either side, the other extending over the ocellar triangle; frontal orbits white pollinose; front with parallel sides. Occiput shining blackish, the occipital cilia mixed yellow and black; cheeks shining black except in front. Proboscis brown below; palpi reddish yellow. Face very thinly pale pollinose. Antennæ black, reaching to the oral margin, the second segment sometimes brownish.

Thorax brownish black, very thinly pale pollinose, the hair whitish, not very abundant; bristles yellow.

Coxæ and femora black, yellow-haired; tibiæ brown, the anterior four with black hair; tarsi reddish yellow.

Wings brown, with numerous small, roundish, grayish hyaline spots. Squamæ and halteres yellow.

Abdomen brown, very thinly cinereous pollinose, the hair pale yellow; apical bristles very weak and yellowish.

TYPES.—Holotype, male, Blitzen River, Oregon, July 6, 1906. Paratypes: male, Narrows, Oregon, July 1, 1906, and male, Warm Springs V, Oregon, July 7, 1906. There is also a teneral specimen bearing the same data as the holotype.

Eutreta pollinosa, new species

Related to *diana* Osten Sacken but with thickly pollinose mesonotum and wholly yellow bristles on the thorax. Differs from *rotundipennis* Loew in the narrower wings and the entire apical hyaline band. Length, about 3 mm.

MALE.—Head reddish yellow in ground color, the occiput paler below, darker above and with a large rectangular black spot above the neck. Front wide, with almost parallel sides, the hairs and bristles yellow. Occiput whitish pollinose below, yellowish above, the occipital cilia mixed black and whitish. Face and frontal orbits with white pollen, the former without black spots. Palpi and proboscis reddish yellow, the palpi with only a few short black hairs. Antennæ reddish, short, the arista brown on the apical half or more.

Thorax apparently black in ground color, with the scutellum, upper border of the pleura in front of the wings and most of the mesopleura yellowish. Humeri and notopleura pale in ground color. Pollen thick, brownish yellow. Hair and bristles yellow.

Legs reddish yellow, the hair and bristles of the same color.

Wings brown, the apex hyaline; disk with abundant yellowish hyaline spots, those in the discal cell mostly more or less fused, the spots larger than usual. Squamæ and halteres pale yellow.

Abdomen black in ground color, the apex yellow, moderately cinereous pollinose; hair and bristles pale yellowish. Genitalia brownish red.

TYPE.—Male, Antelope Mt., Harney Co., Oregon, 6500 ft., September 4, 1931 (D. K. Frewing).

Eutreta jonesi, new species

Related to *diana* Osten Sacken but distinguished by the presence of only black hairs and bristles on the pleura, the propleura alone with a few whitish hairs. Length, about 5 mm.

MALE.—Head black, the face, cheeks and front pale yellow, the face and cheeks with whitish pollen. Front wide, with almost parallel sides, the bristles brown, the hair very pale yellow. Occiput shining, the occipital cilia mixed black and white. Proboscis yellow; palpi pale yellow, with pale yellow hairs and a few black bristles. Antennæ reddish yellow, short; second segment with black hair; arista mostly brownish.

Thorax shining black; mesonotum with moderately abundant appressed pale yellow hair; bristles brownish or brownish red.

Legs blackish, the tips of the tibiæ, and the tarsi entirely, reddish; knees very narrowly reddish. Hair and bristles black.

Wings dark brown, with numerous small hyaline spots as in *diana* Osten Sacken.[1] Squamæ cinereous, with brown border. Halteres yellow, the apical half brownish red.

Abdomen shining black, the basal one or two segments more or less brick-red, especially toward the sides. Ovipositor shining black. Hair mostly black, in some views appearing brownish.

TYPES.—Holotype, female, Antelope Mt., Harney Co., Oregon, 6500 ft., July 7, 1931 (D. K. Frewing). Paratype, male (?) (abdomen missing), Stein Mountains, Harney Co., Oregon, June 25, 1922 (W. J. Chamberlain).

In *diana* Osten Sacken the pteropleura bears yellowish or whitish hair in addition to the one or two black bristles and the hair on the mesopleura is wholly pale yellowish.

Eutreta diana Osten Sacken

OSTEN SACKEN, 1877, 'Western Diptera,' p. 347.

Eutreta diana tricolor SNOW, 1894, Kans. Univ. Quart., II, p. 168.

PHILLIPS, 1923, Journ. N. Y. Ent. Soc., XXXI, p. 141, (f.).

Male, Colorado (Wheeler Collection); female, Lusk, Wyoming, August 26, 1895 (Wheeler); female, Medicine Hat, Alberta, Canada, August 21, 1924 (F. S. Carr); male and two females, Musselshell Co., Montana, August 18, 1917 (A. L. Strand?).

The males may have the abdomen red with the fourth segment black or brown or wholly brown, while the females have the abdomen red with the ovipositor, and sometimes the fourth segment, black.

[1] Phillips, 1925, Journ. N. Y. Ent. Soc., XXXI, Pl xix, fig 41.

AMERICAN MUSEUM NOVITATES

Number 558 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Sept. 14, 1932

59 82 (85)

STUDIES OF PERUVIAN BIRDS. VII

THE GENERA *PYGIPTILA*, *MEGASTICTUS*, *DYSITHAMNUS*, *THAMNOMANES*, *CERCOMACRA*, AND *PHLEGOPSIS*

BY JOHN T. ZIMMER

The systematic studies of Peruvian birds have been continued with the examination of the genera mentioned in the title. As before,[1] these studies have necessarily extended beyond the boundaries of Perú, and various extralimital forms will be found discussed in their relationship to the Peruvian avifauna.

Acknowledgment is made to the various institutions which have generously loaned material needed for comparative study.

Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

Pygiptila stellaris maculipennis (Sclater)

Thamnophilus maculipennis SCLATER, 1855 (April), Edinb. New Philos. Journ., (N.S.) I, p. 247—"Quixos in Cisandean Ecuador and Chamicurros, on the Peruvian Amazon"; ♂, ♀; cotypes in British Mus.

With a series of more than two hundred and fifty skins of this species at hand from various parts of its range, the variability of most of the characters becomes apparent. At the same time, the series shows certain definite average differences in some regions in which individuals may vary, but which are constant enough to deserve recognition by name.

Typical *stellaris* ranges from Pará west to and including the right bank of the Rio Madeira, and southward to western Matto Grosso. North of the Amazon, in the neighborhood of Mt. Duida, the upper Rio Negro, the Uaupés, Cassiquiare, Orinoco, and Caura, and apparently eastward to the Guianas, another form exists. The males are not certainly separable from those of *stellaris*, but the females have the upper parts distinctly darker and clearer gray including the whole back of the head, sometimes as far forward as the posterior border of the forehead. The tertials and inner secondaries, the inner lesser upper wing-coverts, and the middle rectrices also are blue-gray.

[1]Earlier papers in the series comprise American Museum Novitates Nos. 500, 509, 523, 524, 538, and 545.

In *stellaris* females the back is sometimes inclined to bluish gray, but usually it is dulled by brownish tips if not entirely suffused with light brown; the scapulars and inner remiges are distinctly brown rather than gray and the middle retrices are often brownish. The under parts are often clearer and deeper cinnamomeous buff without a certain grayish dullness that characterizes most of the northern birds.

In eastern Ecuador and eastern Perú on both sides of the Amazon there exists a form which is not so well marked as the Venezuelan one but which is distinguishable from *stellaris* by some of the same characters somewhat modified. The males are much less clearly bluish gray on the back than the Venezuelan birds and, while the back of the head is often darker than the forehead and crown, it is not clear gray in any example that I have seen, but is usually only a darker shade of brown. The tertials, inner secondaries, and median rectrices are likewise duller than in Venezuelan birds, but are still more distinctly grayish than brownish. Actually this form is precisely intermediate between *stellaris* and the Venezuelan birds. For it the name *maculipennis* may be used, as will be discussed below.

On the Rio Purús a fourth form exists which has been described by Todd as *purusiana*. It is characterized by a still greater development of the brownish upper surface of the females, being more extreme than *stellaris*. The entire back and head are brownish in some examples, with little trace of the gray that is found to some extent in all the other forms. Birds from Teffé may be referred to this form but most of the examples from the left bank of the Rio Madeira are not clearly separable from *stellaris*, though a few of them have the brownish tones of *purusiana* as does an occasional skin from east of the Madeira.

The fixation of a definite type locality for *maculipennis* is a problem which requires more than a casual glance although it does not affect the nomenclature of the group one way or the other, as I interpret the systematics of the species.

Sclater (P. Z. S. London, XX, p. 112, 1854) recorded and described certain specimens from Quixos, eastern Ecuador, under the name "*Thamnophilus stellaris* Spix?". The following year (1855, Edinb. New Philos. Journ., (N. S.) I, p. 247) he considered Spix's bird as unidentifiable and proposed *maculipennis* as a new name for the Quixos birds, adding "Chamicurros, on the Peruvian Amazon (Gould)" as an additional locality and stating that he had seen examples from the upper Peruvian Amazon and adjoining countries, in the Paris Museum and elsewhere. A full description was given of the new form. In 1862 ('Cat. Coll.

Amer. Birds,' p. 176), a male from "Peruvian Amazon" and a female from "Rio Negro" (=Río Napo) are said to be "types of the species, as described." In 1890 ('Cat. B. Brit. Mus.,' XV, p. 217) the male from the Peruvian Amazon alone is said to be the type. The fact that in 1862 no single skin was pointed out as the type makes it extremely doubtful that any individual specimen was so selected at that time, in which case all the examples from which Sclater drew up his description are equal cotypes. These include a pair from Chamicuros, Perú (Gould collection), and examples said to be in the Paris Museum collected by Castelnau and Deville. If it can be shown that Sclater marked only the "Peruvian Amazon" male as type at the time the description was published, that specimen is then the type.

In any case, Sclater's selection of this specimen in 1890 for special consideration may be justly interpreted as a restriction of type locality to the Peruvian Amazon, though for greater clarity the restriction should be made more definite. To avoid confusion, I suggest Puerto Indiana, at the junction of the Napo and the Amazon in Perú, as type locality of *P. s. maculipennis*, being a spot easily accessible to collectors at the date of the discovery of this bird, and furthermore representing both the Río Napo and the Peruvian Amazon mentioned by the describer.

Females from south of the Amazon, in Perú (such as probably also at Chamicuros), average a trifle browner, especially on the head, than birds from north of the Amazon and seem to show a tendency toward *purusiana* while remaining closer to *maculipennis*. Some of them are hardly separable from typical *stellaris* which is an intermediate of that nature.

There remains to be named the form from the vicinity of southwestern Venezuela which is to be described as follows.

Pygiptila stellaris occipitalis, new subspecies

Type from the right bank of the Río Cassiquiare, Venezuela, opposite El Merey. No. 211,030, American Museum of Natural History. Adult female collected April 23, 1929, by the Olalla brothers.

Diagnosis.—Similar to *P. s. maculipennis* of eastern Ecuador and Perú; males indistinguishable; females clearer bluish slate on the upper surface and with the occiput and sometimes the crown also slate-gray like the back, instead of olive brownish or tipped with olive-brown. Separable from females of *stellaris* from eastern Brazil (south of the Amazon) by the same features, with added prominence given to the tertials, scapulars, and middle rectrices which are gray in *occipitalis* and brown or olive-brown in most *stellaris*.

Range.—Southwestern Venezuela in the vicinity of Mt. Duida, and adjacent parts of Brazil and Colombia on the upper Rio Negro and Rio Uaupés; thence through

the Caura Valley and the upper Orinoco country and probably across the three Guianas.

Description of Type.—Forehead and narrow superciliary line dull Buffy Brown, merging above the orbit with the gray of the crown; rest of upper parts including tertials, exposed portions of inner three secondaries, middle rectrices and outer webs of remaining rectrices clear Slate-Gray; mantle with a large white area concealed at the bases of the feathers which are somewhat sooty gray subterminally; lores pale buff; auriculars and sides of neck dark Buffy Brown, paler at the bases of the feathers; chin and throat light Cinnamon-Buff; breast a little darker and browner; belly and under tail-coverts paler than the breast but duller; sides and flanks distinctly tinged with grayish olive. Lesser upper wing-coverts on radial margin of wing gray like the back but with traces of buffy olive at the tips; lower lesser coverts, median series, and alula browner, with tips somewhat cinnamomeous; greater series like the middle series but inner ones gray like the tertials; primaries with outer margins Cinnamon-Brown and with traces of bluish gray at tips; outer secondaries with the gray broader at tips of outer webs and extending basad along the outer margin, tending also to give an olive tinge to the remainder of the brown outer web; inner secondaries and tertials like the back as described; under wing-coverts, axillars, and inner margins of primaries and secondaries deep Cinnamon. Maxilla blackish (in dried skin); mandible slaty at base, pale at tip; feet dull brownish. Wing, 76 mm.; tail, 40; exposed culmen, 19; culmen from base, 24; tarsus, 20.5.

Remarks.—Males with top of head and nape black, but forehead sometimes narrowly gray or with the feathers margined with gray; lores and a narrow superciliary line light bluish gray; back dark Slate-Gray; interscapulars with a large concealed white area at the bases of the feathers bordered terminally by black; this black sometimes is confined to the subterminal portion of the feathers or even to the inner webs where it is concealed enough to leave the exposed surface of the mantle entirely gray; usually the tips of many interscapulars are entirely and broadly black, making a large black patch which is usually separated from the black of the nape by a gray area, though sometimes continuous with it; rump, upper tail-coverts, middle remiges, and outer webs of remaining remiges Slate-Gray. Throat, breast, and lower under parts Deep Gull Gray; chin a little paler; lores and auriculars a little darker. Remiges blackish with outer margins light Slate-Gray, inner margins Light Drab; upper wing-coverts Slate-Gray with a variable amount of black subterminally and with a triangular white spot at the tip of each feather, sometimes very small on the inner feathers of the greater series, but usually large and conspicuous; under wing-coverts gray. Maxilla black; mandible bluish slate, paler at tip; feet blackish brown. Wing, 74–80.25 mm.; tail, 37–42; exposed culmen, 17–20; culmen from base, 23–24.5; tarsus, 19–20.

Young females are like adult females in general coloration except

that the back of the head is likely to be brownish or tipped with brownish, the tertials, inner secondaries, middle rectrices, scapulars, and inner lesser upper wing-coverts duller gray or tinged with olive, and the white area concealed on the mantle duller or sometimes partially tinged with pale cinnamomeous.

Young males are like young females though sometimes grayer on the upper surface and with definite blackish subterminal areas on the interscapulars.

Curiously, there are no specimens nor records from the north bank of the Amazon although there are good collections at hand from the lower Rio Negro and the Jamundá. Similarly, there is a break in the known distribution from the Rio Uaupés in Brazil and Colombia to the Napo and its affluents where *maculipennis* occurs. In addition to its taxonomic differences, therefore, *occipitalis* seems to possess geographic isolation.

Specimens Examined

P. s. stellaris.—Brazil: Utinga, Pará, 1 ♀; Mocajuba, Rio Tocantins, 2 ♂; Baião, 1 ♂; Malocca (de Manoelsinho), Rio Curuá, 1 ♂, 1 ♀; Tauary, Rio Tapajoz, 1 ♂; Igarapé Amorín, 1 ♂; Tucunaré, Rio Jamauchim, 1 ♂; Villa Braga, 2 ♀[1]; Miritiba, 2 ♀[1]; Itaituba, 1 ♀[1]; Aveirao, 1 ♀[1]; Santarem, 9 ♂[1]; Villa Bella Imperatríz, Rio Amazonas, 4 ♂, 2 ♀; Borba, Rio Madeira, 10 ♂, 8 ♀; Igarapé Auará, 6 ♂, 4 ♀; Rosarinho, 6 ♂, 6 ♀; Monte Cristo, Matto Grosso, 1 ♂; Barão Melgaço, 1 ♂.

P. s. purusiana.—Brazil: Hyutanahan, Rio Purús, 4 ♂[1], 4 ♀[1] (incl. type); Arimã, 2 ♀[1]; Nova Olinda, 2 ♀[1]; Teffé, 3 ♂, 3 ♀.

P. s. maculipennis.—Ecuador: Río Suno, above Avila, 1 ♂, 2 ♀; lower Río Suno, 2 ♂, 4 ♀; below San José, 3 ♂; mouth of Río Curaray, 2 ♂, 2 ♀; mouth of Lagarto Cocha, 1 ♂. Perú: Puerto Indiana, 2 ♀; Lagarto, upper Ucayali, 5 ♂, 3 ♀; Santa Rosa, 10 ♂, 3 ♀; Sarayacu, 5 ♂, 5 ♀; Orosa, Río Amazonas, 3 ♂, 4 ♀; Puerto Bermúdez, Río Pichis, 1 ♂[2]; Contamana, 1 ♂[2].

P. s. occipitalis.—Venezuela: El Merey, Río Cassiquiare (left bank), 3 ♂, 5 ♀; opposite El Merey (right bank), 6 ♂, 6 ♀ (incl. type); (vicinity of Mt. Duida), 24 ♂, 18 ♀; Río Orinoco at mouth of Río Ocamo, 3 ♂, 8 ♀; opposite mouth of Río Ocamo, 5 ♂, 3 ♀; Boca de Sina, upper Orinoco, 2 ♂, 2 ♀; Río Mato, 1 ♂, 1 ♀; Suapuré, 1 ♂; La Unión, Río Caura, 3 ♂, 1 ♀. Colombia: Río Uaupés, opposite Tahuapunto, 1 ♂. Brazil: Tahuapunto, Rio Uaupés, 3 ♂, 2 ♀; Iauaraté, 1 ♂, 2 ♀; Tatú, Rio Negro, 11 ♂, 5 ♀; Yucabi, 2 ♂, 1 ♀; Mt. Curycuryari, 2 ♂, 1 ♀.

Megastictus margaritatus (Sclater)

Myrmeciza margaritata Sclater, "1854" = April, 1855, P. Z. S. London, XXII, p. 253, Pl. lxxi; Chamicuros, Perú; ♂, ♀; cotypes in British Mus. (skin in Acad. Nat. Sci. Phila. possibly also a cotype).

[1]Specimens in Carnegie Museum, Pittsburgh.
[2]Specimens in Field Museum of Natural History, Chicago.

The distribution of this species is curious. The records are from scattered places which seem to be quite disconnected, and abundant collections from intervening regions do not show the presence of this bird where it would be expected. The material at hand adds several interesting localities to the list, some of which are in regions previously worked without the discovery of the species. It is possible, therefore, that there is an actual continuity of range over an extensive area but that the bird is locally rare or subject to ecological restrictions that are not yet understood. The localities from which it is known are all in the lower Humid Tropical Zone and without any zonal barriers separating them. Plotted on a map they roughly outline the periphery of a circle, the central area of which is without records at present.

The study of more than fifty skins from different parts of the range shows no differences that have any geographic significance. Some of the males are paler gray than others, or vary in the degree of whiteness of the throat and under tail-coverts or in the size of the white tips on the rectrices. The females have varying tones of ochraceous below and brown above, but the extremes are often from the same region. The size is equally variable in all localities.

Records from Perú, not shown by the material examined, are from Chamicuros and Jeberos.

Specimens Examined

M. margaritatus.—Perú: Lagarto, upper Ucayali, 10 ♂, 7 ♀; Puerto Indiana, 1 ♂, 1 ♀; Apayacu (=Anayacu), 1 ♂. Ecuador: mouth of Lagarto Cocha, 1 ♂; mouth of Río Curaray, 2 ♀. Venezuela: Esmeralda, Mt. Duida, 2 ♂, 1 ♀; Lalaja, 1 ♂, 1 ♀; Río Pescada, 1 ♂, 1 ♀. Brazil: Mt. Curycuryari, Rio Negro, 6 ♂, 4 ♀; Yucabi, 1 ♂, 2 ♀; Igarapé Auará, Rio Madeira, 4 ♂, 4 ♀; Borba, 1 ♂, 1 ♀.

Dysithamnus mentalis olivaceus (Tschudi)

Th(amnophilus) olivaceus Tschudi, 1844 (May), Arch. Naturg., X, (I), p. 278—Perú (Montaña de Vitoc desig., Hellmayr, 1924); ♂ juv.; Mus. Neuchâtel.

In spite of the considerable individual variation exhibited by the present species in its Andean range, there are certain features that remain relatively constant on which it is possible to recognize distinct subspecies in several parts of this region. Dr Chapman (Amer. Mus. Novit., No. 205, pp. 4–6, 1925) has shown that the supposed continuous range of "*olivaceus*" is broken in eastern Ecuador by the occurrence of *napensis* and again in northern Perú by *tambillanus*. I have already remarked (Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 325, 1930)

that birds from the upper Huallaga are closer to *tambillanus* than to *olivaceus*. In southeastern Perú and northwestern Bolivia, the birds of this species are again different though in need of a name (which is supplied below). The name *olivaceus* thereby becomes necessarily restricted to the inhabitants of the Chanchamayo Valley and immediately adjacent regions.

The birds of the Chanchamayo Valley are characterized, in the male sex, by having the mantle and lower back uniformly grayish olive-green; the belly is relatively clear lemon-yellow without a definite white area on the uppermost portion adjoining the grayish breast; the throat is white in noticeable contrast to the breast; the lesser and median wing-coverts are black with whitish tips but no gray margins. Females do not show any distinctive characters of note but are relatively clear yellow on the belly (not strongly buffy) and olive on the back. These combinations of characters are not found regularly in birds from other parts of Perú. No specimens are available from the Urubamba Valley, but from the geographical position of this region, the resident form should be *olivaceus*. Thus, in addition to the localities from which material is recorded below, Idma, La Gloria, Monterico, Río Perené, Ropaybamba, Amable Maria, Paltaypampa, and Garita del Sol have records of *olivaceus* (*sensu strictu*). A male and a female from Pozuzo (Hellmayr, Arch. Naturg., LXXXV, A, (10), pp. 91, 92 (in text), 1920) are to be assigned neither to *olivaceus* nor to *tambillanus* without examination of the specimens.

Dysithamnus mentalis tavarae, new subspecies

Type from Río Tavara, Perú; altitude 1600 feet. No. 147,668, American Museum of Natural History. Adult male collected July 2, 1915, by H. and C. Watkins.

Diagnosis.—Similar to *D. m. tambillanus* of northern Perú, south of the Marañón, but wings and tail shorter; males with lesser and median upper wing-coverts more deeply blackish (less grayish) and with more sharply defined white tips; flanks duller, more grayish olive; throat whiter. Females not always recognizably distinct from *tambillanus* but somewhat browner, less olive, on back and duller, more buffy yellow on belly. Compared with *D. m. olivaceus* of the Chanchamayo Valley, the males are distinguishable by smaller size and by having the upper part of the mantle decidedly grayer and less olivaceous than the rump, the belly less strongly yellowish, the flanks more grayish olive. Females not certainly distinguishable but those of *tavarae* usually browner and less olive on the back and with more of an ochraceous tinge in the yellow of the belly; wings and tail shorter; supra-auricular region less noticeably pale, not whitish.

Range.—Southeastern Perú and northwestern Bolivia.

Description of Type.—Top of head deep Neutral Gray x Dark Neutral Gray; mantle paler and with a light slaty tinge; lower back, rump and upper tail-coverts Deep Olive-Gray x Dark Olive-Gray. Lores whitish gray; a barely perceptible super-

ciliary stripe of pale gray, not sharply contrasting with the crown; auriculars sooty gray; malar region whitish with gray tips; chin and throat white; sides of throat, sides of neck, sides of breast and a broad area across breast Light Neutral Gray contrasting somewhat with the white gular area; middle of upper abdomen white bordered laterally on the upper flanks with Light Neutral Gray; lower abdomen and under tail-coverts tinged with Marguerite Yellow; lower flanks Grayish Olive x Deep Grayish Olive. Remiges dull dusky brown with outer margins Deep Olive-Gray; greater upper wing-coverts with dull Neutral Gray outer margins and narrow white tips; primary-coverts with gray margins and outermost covert with a narrow white border rounding the tip; alula with white outer borders; median and lesser coverts black with narrow white tips, obsolete on some of the lesser series; radial margin of wing with a well-developed white patch continued on the margins of some of the scapulars; under wing-coverts grayish white with dusky bases along outer margin of wing, pale yellowish at base of quills; inner margins of remiges Marguerite Yellow. Rectrices with outer margins gray (faintly olivaceous); tips of outermost pair narrowly white, the white tips suggested on several subterminal pairs. Maxilla blackish; mandible blackish, inclined toward grayish on lower portion; feet dull brownish. Wing, 61 mm.; tail, 39; exposed culmen, 13.5; culmen from base, 16.5; tarsus, 19.

REMARKS.—Females with top of head deep Amber Brown x Sanford's Brown, brighter on the forehead, darker on the nape and hind neck, and grading rather suddenly into the Light Brownish Olive of the back. Lores buffy white; a narrow ring around eye pure white; a supra-auricular stripe like the lores or a little duller; auriculars buffy brown with whitish shafts; malar region, sides of neck, sides of breast, and broad band across breast dull grayish buff, enclosing a white or whitish gular patch; middle of upper belly whitish; lower belly dull, pale Colonial Buff; under tail-coverts Isabella Color, flanks darker. Remiges with outer margins light Saccardo's Umber; upper wing-coverts margined with the same and sometimes with faintly paler tips; wing-lining as in male but a little more tinged with ochraceous. Tail dark Saccardo's Umber; outer rectrices obsoletely tipped with buffy whitish. Maxilla black; mandible whitish; feet dusky brown. Size about that of the males or averaging slightly smaller.

An occasional male shows an olive tinge on the mantle and a yellow area on the belly (one male from Monos, Bolivia and one from La Pampa, Perú). These birds appear to be not fully adult, though the two in question are both labeled as having enlarged testes. With these exceptions, the male birds at hand are readily distinguishable.

Dysithamnus mentalis aequatorialis Todd

Dysithmanus mentalis aequatorialis TODD, 1916, Bull. A. M. N. H., XXXV, pp. 535, 539—Zaruma, Province del Oro, Ecuador; ♂; Amer. Mus. Nat. Hist.

Dr. Chapman (Bull. Amer. Mus. Nat. Hist., LV, p. 386, 1926) has already recorded the occurrence of this form at Milagros, Perú. The male and the female on which this record is based are at hand and agree perfectly with the type and sixty-five additional skins from western Ecuador. There are no other records from Perú.

Dysithamnus mentalis tambillanus Taczanowski

Dysithamnus tambillanus Taczanowski, 1884, 'Orn. Pér.,' II, p. 30—Tambillo, n. Perú; ♂; formerly Warsaw Mus., now lost.

Examples from northern Perú, from Chinchao (near the upper Huallaga) to San Ignacio (near the Río Chinchipe) are distinct from *olivaceus* by reason of more grayish backs of the males, grayer (less whitish) throats, and whiter (less yellowish) bellies. For these birds the name *tambillanus* is available. Localities other than those listed below, from which there are records of this form, are Huambo, Chirimoto, Cococho, and Tambillo.

Specimens Examined

D. m. semicinereus.—Colombia: Buena Vista, 5 ♂, 3 ♀; La Candela, 2 ♂, 2 ♀; near San Agustin, Huila, 1 ♂; Mambita, 1 "♀" (=♂); "Bogotá," 1 ♂, 2 ♀; Andalucia, 1 ♀; El Consuelo, 2 ♀.

D. m. napensis.—Ecuador: below San José, 4 ♂ (incl. type), 1 ♀; Zamora, 1 ♂, 1 ♀; Río Suno, above Avila, 3 ♂.

D. m. aequatorialis.—Ecuador: Zaruma, 1 ♂ (type), 1 "♀" (=♂); (Pullango, El Chiral, Alamor, Santa Rosa, Punta Santa Ana, Gauinche, Chongocito, Salvias, Esmeraldas, Coco, Chongon Hills, Chone, Portovelo, Cebollal, and Cerro Manglar Alto), 64 skins. Perú: Milagros, 1 ♂, 1 ♀.

D. m. tambillanus.—Perú: Chaupe, 2 ♂, 6 ♀; Lomo Santo, 2 ♂, 2 ♀; Huarandosa, 1 ♂, 1 ♀; Santa Rosa (Huallaga), 1 ♂; San Ignacio, 1 ♂, 1 ♀; Chinchao, 1 ♂[1], 1 ♀[1]; Vista Alegre, 4 ♂[1]; Huachipa, 6 ♂[1], 3 ♀[1]; Moyobamba, 1 ♂[1].

D. m. olivaceus.—Perú: Tulumayo, 6 ♂, 4 ♀; La Merced, 1 ♂; Perené, 1 ♀[1].

D. m. tavarae.—Perú: Río Tavara, 7 ♂ (incl. type), 5 ♀; La Pampa, 5 ♂, 1 ♀; Río Inambari, 1 ♂, 2 ♀. Bolivia: Todos Santos, 2 ♂, 3 ♀; Monos, 1 ♂; Ticunguaya, 1 ♂; Vermejo, 1 ♀.

D. m. affinis.—Brazil: Chapada, Matto Grosso, 35 skins; Rio San Lorenzo, 1 ♂.

Dysithamnus ardesiacus ardesiacus Sclater and Salvin

Dysithamnus ardesiacus Sclater and Salvin, 1867, P. Z. S. London, p. 756—new name for *Dysithamnus schistaceus* Sclater (*nec Thamnophilus schistaceus* D'Orbigny), 1858, P. Z. S. London, p. 66; Río Napo, Ecuador.

The study of the material at hand has not yielded very satisfactory results. Two females from Puerto Indiana, at the mouth of the Napo in

---

[1]Specimens in Field Museum of Natural History, Chicago.

Perú, agree well with other Napo skins (from higher up the river) and unquestionably belong to typical *ardesiacus*. Birds from the Río Suno also are fairly typical. There is some variation, however, in this material. Two males from the Río Suno have the white interscapular patch present though small. One male from the mouth of Lagarto Cocha has the patch well developed; one from the mouth of the Curaray has it almost obsolete. Two females from the Curaray and one from the Suno have no white; the others have a noticeable amount.

Three males and a female from Pomará (middle Marañón), Perú, and a female from west of Moyobamba seem to be referable also to *ardesiacus*, although at first glance they appear to be not quite typical. Two of the males are fully adult and show the gular patch below the chin as solidly black, narrowly tipped with gray, as it is in *D. a. obidensis*. The third male is still immature with many remains of juvenal plumage, but much of the gular patch is already in adult condition and is quite broadly tipped with gray as in most *ardesiacus*. The white dorsal patch is present in all three skins, though smallest in the young bird.

The two females are more olivaceous in dorsal tone than the average of *ardesiacus* (thereby being farthest removed from *obidensis*, but they are in very fresh plumage which is matched very well by some of the topotypical specimens. One has a small white patch on the mantle, the other has no white on the back.

A series of skins from the upper Ucayali probably must be referred to the same form, though they are consistent in the complete absence of white on the mantle. A series in Field Museum of Natural History from Puerto Bermúdez, on an affluent of the upper Ucayali, are similarly consistent as I have already recorded (Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 326, 1930). Since the development of this white area is a variable character in typical *ardesiacus*, it appears to be of doubtful value as a criterion for the erection of a new subspecies from this region. Especially is this true in view of a female from Sarayacu, on the lower Ucayali, which has a well-developed patch of white on the back. This skin and a female from Lagarto are browner than the average *ardesiacus*; another Lagarto skin and one from Santa Rosa may be matched in the Ecuadorian series. The Puerto Bermúdez females, though not compared directly with the material now at hand, are described in my notes as Brownish Olive above, which is the exact color of many of the Ecuadorian birds.

The extent of black on the throat of the males has been shown to be variable in the northern examples of *ardesiacus*. In the upper Ucayali

region, this black is at a minimum, though no more reduced than in some of the most northern skins. I conclude, therefore, that there is no constant difference in the coloration of either sex from the two regions.

In the matter of distribution, there are some questions still unanswered. As noted above, a single specimen from near Sarayacu, lower Ucayali, appears to belong to *ardesiacus* and not to the *saturninus* group (as will be discussed under the latter species). Also at Sarayacu (or across the river from it) occurs *D. saturninus huallagae* which ranges thence down the lower Ucayali to the Amazon and westward to the east bank of the lower Huallaga whence it was originally described.

Apparently there are no existing specimens which belong to *ardesiacus* from the east bank of the Huallaga. Sclater and Salvin (P. Z. S. London, 1873, p. 274) record *ardesiacus* from Chamicuros on the strength of Edward Bartlett's note that he secured a male and a female at that locality. Sclater, Taczanowski, and others have quoted this record, but no one, apparently, has recorded the actual specimens unless under another name without reference to Bartlett's note. It is possible that the skins were misidentified by Bartlett and that they have been recorded accurately under some other name without detection of their relation to Bartlett's record of *ardesiacus*. All other records of *ardesiacus* from the neighborhood of the Huallaga are from the left bank; these records are from Yurimaguas and Chayavitas.

Taczanowski ('Orn. Pér.,' II, p. 32, 1884) lists records from Chayavitas, Chamicuros, Iquitos, and Amable Maria. Only the first locality is of unquestionable authenticity. Chamicuros is in doubt as remarked above. Iquitos is possibly correct, but the specimens in question are listed by Hellmayr under *saturninus*, though with a query.

The Amable Maria record is very questionable. The locality is outside of the otherwise recognized range, though not impossibly so, but the description given by Taczanowski of the male (most probably based on an Amable Maria skin collected by Jelski), does not belong with this species at all but seems to be that of *Schistocichla leucostigma intensa*. The real *Dysithamnus ardesiacus* is described by Taczanowski as "*Hypocnemis melanopogon*" from skins collected by Stolzmann at Yurimaguas; of the bird now known as *Schistocichla leucostigma intensa*, Taczanowski had no specimens identified by him as such (under the name *Hypocnemis schistacea*).

There is, as may be seen, an apparent hiatus in the range of *ardesiacus* between the Huallaga and Ucayali rivers. It is possible that this hiatus is bridged by way of the upper portion of the Pampas del Sacra-

mento, although I did not find the species on the upper Huallaga which probably would form a part of this bridge. If the *saturninus* group could be considered as conspecific with *ardesiacus*, it would form a connecting link between the upper Ucayali "colony" and the lower Huallaga birds, though the range of *ardesiacus* would be none the less divided. However, the evidence seems to show that *ardesiacus* and *saturninus* are specifically distinct, as is discussed under *D. saturninus huallagae.*

SPECIMENS EXAMINED

D. a. ardesiacus.—ECUADOR: Río Suno, above Avila, 2 ♂; lower Río Suno, 3 ♀; mouth of Lagarto Cocha, 1 ♂; mouth of Río Curaray, 1 ♂, 2 ♀. COLOMBIA: Florencia, 2 ♂, 1 ♀; La Morelia, 1 ♂. PERÚ: Puerto Indiana, 2 ♀; Pomará, 3 ♂, 1 ♀; Río Negro, west of Moyobamba, 1 ♀; Puerto Bermúdez, 4 ♂[1], 4 ♀[1]; Sarayacu, Río Ucayali, 1 ♀.

D. a. obidensis.—BRAZIL: Faro, 3 ♂, 7 ♀; Teffé, 3 ♂, 2 ♀; Yucabi, Rio Negro, 2 ♂; Mt. Curycuryari, 2 ♂, 2 ♀; Tatú, 3 ♂, 8 ♀; Tahuapunto, Rio Uaupés, 4 ♂, 2 ♀. VENEZUELA: (vicinity of Mt. Duida, Río Cassiquiare, upper Orinoco, etc.), 13 ♂, 8 ♀; Nicará, Río Caura, 1 ♂; Suapuré, 2 ♂, 1 ♀. BRITISH GUIANA: Kamakusa, 1 ♂; Rockstone, 2 ♂, 5 ♀. Tumatumari, 5 ♂; Potaro Landing, 2 ♂; Minnehaha Creek, 1 ♂. FRENCH GUIANA: Ipousin, 1 ♂, 2 ♀.

Dysithamnus saturninus huallagae (Cory)

Cercomacra huallagae CORY, 1916 (August), Field Mus. Nat. Hist. Publ., Orn. Ser., I, No. 10, p. 338—Lagunas, lower Huallaga, Perú; ♂; Field Mus. Nat. Hist.

Twenty-four skins from the region between the right bank of the Rio Madeira and the left bank of the Rio Tapajoz unquestionably belong to typical *saturninus*, described from Borba. Seventeen skins from the lower Ucayali and from Orosa on the south bank of the Amazon below the mouth of the Ucayali are distinctly related to *saturninus* rather than to *ardesiacus*, though they show certain differences that entitle them to separate recognition under the name *huallagae*. While the Rio Madeiran females have quite uniformly white throats, the Peruvian females have that area somewhat noticeably tinged with pale ochraceous (not so deeply as in the females of *ardesiacus*) and sometimes with darker subterminal markings that tend to form small, paired, marginal spots. The males are not clearly distinct, but have the black throat patch averaging longer, the belly darker. Specimens from Hyutanahan, Rio Purús (Carnegie Museum) are intermediate but possibly closer to true *saturninus*.

Compared with *ardesiacus* (*a. ardesiacus* and *a. obidensis*), the males of the *saturninus* group have a generally darker and harder plumage; the first primary is longer in proportion to the length of the wing; the

[1]Specimens in Field Museum of Natural History, Chicago.

tail is relatively longer; the bill is longer; the throat is much more extensively black with the same obscurity invading the upper breast and the malar region and even the upper abdomen; the belly has noticeable white shaft-streaks; the upper wing-coverts have whitish tips and there are clear white markings on the upper portion of the bend of the wing (sometimes suggested in *D. a. obidensis* from Guiana); the concealed white patch on the mantle is large and very well defined. Females have the dorsal surface, including the outer exposed surface of the wings, richer brown; the throat is white or whitish in contrast to the breast; the white interscapular patch is strongly developed; the measurements are as in the males.

I have noted in the discussion of *D. a. ardesiacus* that some of the females of that form from the upper Ucayali are a little browner than most typical *ardesiacus* females. This might be considered as an approach toward *saturninus huallagae* from the lower Huallaga; the males, however, are widely apart. Some females of *s. huallagae,* on the other hand, are more olivaceous than usual and resemble *ardesiacus* in that respect alone. One male and three females from near Sarayacu (whether right or left bank is not known) are typical *huallagae* in all respects. Another female from the same region (possibly not the same bank) seems to be definitely referable to *ardesiacus,* though it differs from the females taken on the upper Ucayali by the presence of some white on the mantle as frequently found in *ardesiacus* from other regions. In general coloration and proportions, this bird is distinct from the other Sarayacu skins, though it might be taken as an intermediate between *ardesiacus* and *huallagae.*

However, Todd (MS.) notes both *a. obidensis* and *s. huallagae* from Tonantins. Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 126, 1924) refers Nauta specimens to *saturninus* (*huallagae* not recognized) and Iquitos records doubtfully to the same form; the skins now before me from Puerto Indiana, not far below Iquitos on the same bank of the Amazon, are *ardesiacus.* The occurrence of both groups at Sarayacu has been mentioned (though the two may be separated by the river at that locality. Furthermore, *a. obidensis* crosses the Amazon to the south bank west of the Rio Madeira where it interrupts the range of the *saturninus* group at Teffé (and probably also at Nova Olinda, Arimã, and Caviana whence Mr. Todd writes that he has specimens which he refers to the *ardesiacus* group); higher up the Purús, at Hyutanahan, on the same side of the river as Nova Olinda, occurs the *saturninus* group.

Except at Tonantins, therefore, and possibly at Sarayacu, there is no

actual coexistence of the two groups, but their distribution and relationships are so far from perfectly understood that I prefer to recognize two specific groups at present.

SPECIMENS EXAMINED

D. s. saturninus.—BRAZIL: Borba, Rio Madeira, 3 ♂, 4 ♀; Igarapé Auará, 2 ♂; Villa Bella Imperatríz, Rio Amazonas, 7 ♂, 6 ♀; Boim, Rio Tapajoz, 1 ♂, 1 ♀; Hyutanahan, Rio Purús, 3 ♂[1], 3 ♀[1]; Igarapé Brabo, Rio Tapajoz, 1 ♀.

D. s. huallagae.—PERÚ: Lagunas, 1 ♂ (type)[2], 1 ♀[2]; Orosa, Río Amazonas, 7 ♂, 3 ♀; Sarayacu, Río Ucayali, 1 ♂, 3 ♀.

Thamnomanes caesius glaucus Cabanis

Th(amnomanes) glaucus CABANIS, 1847, Arch. Naturg., XIII, (1), p. 230—Cayenne; descr. ♂.

Hellmayr [Arch. Naturg., LXXXV, A, (10), p. 96, 1920] considers six males from Yurimaguas, Chamicuros, Xeberos (=Jeberos), Iquitos, and Nauta to be intermediate in coloration between *glaucus* and *schistogynus*. Five females from Iquitos, Chamicuros, Ucayali, and Pebas are said to have the coloration of *glaucus*, and two from Pebas and Nauta are like *schistogynus*. There is no explanation of this confusion to be found in the material at hand which shows a rather regular replacement of *glaucus* and *schistogynus* on opposite sides of the Amazon. Unfortunately, I have no skins from the immediate south bank in Perú where much of the confusion apparently exists. Specimens from the Ucayali are all referable to *schistogynus* (though there are some indications of approach toward *glaucus*); those from the mouth of the Napo are quite typical *glaucus*, without any obvious signs of approach toward *schistogynus*. There is little doubt that the records from Iquitos belong to *glaucus* and that the two brown-backed females from Pebas also belong to that form. It is also quite logical to assign the Jeberos record (and one from Yurimaguas given by Taczanowski) to *glaucus*. Bartlett's Chamicuros skins may belong there also without great question. The brown-backed female collected by Hauxwell on the "R. Ucayali" is not so certain as to the correctness of locality, though it may be an excellent example of *glaucus*. The only other skin of *Thamnomanes* from Hauxwell's collection is a gray-backed female of *schistogynus* labeled as from "Nauta," which is as curious a record as is that of *glaucus* from the Ucayali, where *schistogynus* is a known resident. If the labels of these two skins were transposed, each bird would fit nicely into the distribu-

---

[1]Specimens in Carnegie Museum, Pittsburgh.
[2]Specimens in Field Museum of Natural History, Chicago.

tional record as it is exhibited by the other specimens from the region in question. It is possible, if not highly probable, that the labels were actually exchanged at some time in their history, though there is no proof of it.

The female of *schistogynus* from "Pebas" (Castelnau and Deville) forms another obstacle, but there is a possibility that this locality in the present instance may mean the neighborhood of that town including the opposite side of the Amazon.

In any case, until more definite evidence is available to prove an actual coexistence of *glaucus* and *schistogynus* at various places in northeastern Perú, I shall prefer to consider *schistogynus* as restricted to the south bank of the Amazon from the Juruá to the Ucayali (and southward to Bolivia) and *glaucus* as inhabiting the north bank of the Amazon for the most part but crossing to the south bank in the neighborhood of the Huallaga.

Thamnomanes caesius schistogynus Hellmayr

Thamnomanes caesius schistogynus Hellmayr, 1911 (February), Rev. Franc. d'Orn., II, No. 22, p. 25—San Mateo, n. Bolivia; ♀; Berlepsch Collection, Frankfort Mus.

As mentioned above in the account of *T. c. glaucus*, all the specimens at hand from the Ucayali are definitely referable to *schistogynus*. The same is true of skins from extreme southeastern Perú which are from nearer the type locality than the Ucayali birds. The males of this combined series, including one adult and one young male from Bolivia, show little variation in general coloration and are almost all of the deep bluish gray hue that is characteristic of this form. The exceptions are two of the six males from Sarayacu which are as pale as *glaucus* and have well-developed white inner margins on the remiges (one has much white also on the under wing-coverts). Both birds are not quite fully adult, but other young males from the Ucayali are as dark as the normal adults of *schistogynus*, like the four additional males from Sarayacu. However, one male from Lagarto is intermediate between the pale Sarayacu males and the dark ones, and various otherwise normal males show an unusual development of white on the under side of the wing. I conclude, therefore, that the pale birds from within the range of *schistogynus* are only extremely light-colored examples of that form, though they may also be considered as intermediates between it and *glaucus*.

The females are more variable, but all have the bluish gray dorsum which marks this form. The throat is varyingly grayish with a buffy tone,

whitish with dull grayish tips or margins, or grayish with white shaft-streaks. The under tail-coverts normally are bluish gray, but in various skins, including one from southeastern Perú, are rusty red like the belly. The breast varies from clear gray to buffy olive with brighter tawny shaft-streaks. The outer edges of the remiges are normally bluish gray and the upper wing-coverts are of the same color. One female, apparently adult in all particulars except a slightly softer texture of the gular feathers, shows a distinct approach toward *glaucus* by having the outer margins of the secondaries more tinged with olivaceous, the upper wing-coverts dull sooty brown with only a little bluish gray on the tips, the lores slightly buffy, the under tail-coverts quite deep rufous, and the mantle a little duller gray than usual; the characters are not those of the immature females, of which there are several for comparison.

The range of this form includes the upper Purús, northwestern Bolivia, southeastern Perú, and the Río Ucayali, though the exact north-eastern boundary of this range is not yet determined.

Records from Perú, other than those listed below, are from Marcapata, Río San Gaban, and Yahuarmayo. The doubtful records from Nauta and Pebas have been discussed in the account of *T. c. glaucus*.

Specimens from Teffé eastward to the left bank of the Tapajoz are fairly consistent although the birds from the more eastern localities show a tendency to develop the characters of *hoffmannsi*. One male from Villa Braga, Rio Tapajoz (left bank), has a noticeable patch of white concealed on the mantle, though it is not very sharply defined.

Specimens from the Pará region west to the east bank of the Xingú are relatively uniform in the characters of *hoffmannsi*, though one male from Mocajuba, Rio Tocantins, has a suggestion of white on the mantle, not very pronounced. Twelve skins from the right bank of the Tapajoz are extremely interesting, and so mixed in their characters that it is impossible to name them.

A nearly adult male from near Santarem and a male from Aramanáy are intermediate between *persimilis* and *hoffmannsi*, a little paler than the former and darker than the latter. One female from Santa Elena, Rio Jamauchim, is likewise intermediate, being noticeably duller below than *persimilis*, but slightly more deeply rufescent than *hoffmannsi*; the back is warmer brown, as in *persimilis*. Another female from the same locality is similar but is inclined to brownish below. One female from Aramanáy is so dull below and above that it can be matched best in a series of typical *caesius*. Another female from Aramanáy is so brightly colored that it surpasses the average of *persimilis*. It has some

points of resemblance to *glaucus*, but it is not quite like that form in other respects.

Six additional males from Aramanáy differ from the males of *persimilis*, *hoffmannsi*, and *caesius* by the possession of a large, well-defined white patch concealed on the mantle, as strongly marked as in *glaucus*, from which they can not be distinguished.

Thus, in this restricted region there appears to be a heterogeneous assemblage of individuals representing all the adjacent subspecies and intermediates of various degrees. A careful study in the field will be required to solve the problem presented by this curious situation.

SPECIMENS EXAMINED

T. c. caesius.—BRAZIL: state of Bahia, 5 ♂, 4 ♀; state of Maranhão, 1 ♀; state of Espirito Santo, 9 ♂, 1 (?), 1 ♀; Rio de Janeiro, 1 ♂; "Brazil," 3 ♂ (incl. a cotype).

T. c. hoffmannsi.—BRAZIL: Utinga, Pará, 2 ♂; Peixe Boi, 1 ? (= ♀); Baião, Rio Tocantins, 3 ♂, 1 ♀; Cametá, 1 ♂; Mocajuba, 7 ♂; Villarhino do Monte, Rio Xingú, 4 ♂, 3 ♀.

T. c. persimilis.—BRAZIL: Teffé, 3 ♂, 4 ♀; Monte Cristo, Matto Grosso, 1 "♂" (= ♀); Rosarinho, Rio Madeira, 1 ♂; Santo Antonio de Guajará, 1 ♀; Borba, 2 ♂, 2 ♀; Igarapé Auará, 5 ♂, 6 ♀; Igarapé Brabo, Rio Tapajoz, 7 ♂, 2 ♀; Igarapé Amorín, 1 ♂, 1 ♀; Limoãl, 1 ♂, 1 ♀; Villa Braga, 1 ♂; Villa Bella Imperatríz, Rio Amazonas, 1 ♂.

T. c. subsp. indet.—BRAZIL: Aramanáy, Rio Tapajoz, 7 ♂, 2 ♀; Mararu (near Santarem), 1 ♂; Santa Elena, Rio Jamauchim, 2 ♀.

T. c. schistogynus.—BOLIVIA: Todos Santos, 1 ♂; mouth of Río San Antonio, 1 ♂. PERÚ: La Pampa, 1 ♂; Río Tavara, 2 ♂, 2 ♀; Astillero, 2 ♀; mouth of Río Urubamba, 2 ♀; Lagarto, 10 ♂, 6 ♀; Santa Rosa, Río Ucayali, 2 ♂, 1 ♀; Sarayacu, 6 ♂, 1 ♀.

T. c. glaucus.—FRENCH GUIANA: 3 ♂, 1 ♀. DUTCH GUIANA: 1 ♂, 1 ♀. BRITISH GUIANA: 6 ♂, 4 ♀. VENEZUELA: 84 ♂, 90 ♀. BRAZIL: Faro, 7 ♂, 9 ♀; Obidos, 1 ♀; various localities on Rio Negro, 25 ♂, 21 ♀; localities on Rio Uaupés, 18 ♂, 15 ♀. COLOMBIA: La Morelia, 2 ♂, 2 ♀; Florencia, 1 ♀. ECUADOR: Río Suno, above Avila, 4 ♂, 1 ♀; lower Río Suno, 3 ♂, 1 ♀; below San José, 3 ♂; mouth of Curaray, 6 ♂, 4 ♀. PERÚ: Puerto Indiana, 2 ♂, 8 ♀.

Cercomacra cinerascens sclateri Hellmayr

Cercomacra sclateri HELLMAYR, 1905, Novit. Zool., XII, p. 288—Chyavetas (=Chayavitas), Perú; ♂; Rothschild Collection, American Mus. Nat. Hist.

All the Peruvian birds at hand, from the upper Ucayali, from west of the lower Huallaga, and from southeastern Perú (all regions south of the Amazon and Marañón) appear to belong to the same form, which has been named *sclateri*. This form is characterized by the relatively dark gray coloration of the males (though they are paler than the males of *serva* and the *nigricans* group), conspicuous white tips on the upper wing-

coverts, large white area on the radial margin of the wing, broad white tips on the rectrices, and a large patch of white concealed on the mantle. The females are relatively dark brownish olive on the back and brownish isabelline below, with similar white spots on the upper wing-coverts and rectrices but with a smaller white patch on the shoulder and a smaller white area on the mantle; the rump is decidedly grayish in tone, sometimes with a faint brownish wash, but noticeably different from the brownish-olive mantle.

In contrast to these skins, a series from eastern Brazil, east of the Rio Madeira, shows rather constant differences. The males are paler gray, especially below, and often have more extensive white on the under wing-coverts; the females are somewhat lighter in color also and have the rump practically uniform with the mantle, having also a little more olivaceous tinge on the rectrices; the under wing-coverts are more purely or extensively white.

The paler coloration of the eastern males was noted by Hellmayr (Novit. Zool., XIII, p. 370, 1906; *op. cit.*, XIV, pp. 18, 66, 1907; *op. cit.*, XVII, p. 362, 1910) who, it appears, had only one Peruvian female for comparison and was hence unaware of the differences in that sex. The comparatively fresh material at hand makes the separation of an eastern subspecies now desirable and it is described below.

The single skin from southeastern Perú (Astillero) is not so fresh as the Ucayali series and is perhaps faded. It is slightly paler than the Ucayali birds but darker than most Tapajoz males (much darker than two old skins from Matto Grosso which belong with the new form), while it agrees with the Ucayali birds in having a very little white on the under wing-coverts. Consequently, I believe that it belongs with *sclateri*.

A male and a female from the Río Seco, west of Moyobamba, also are slightly lighter than the Ucayali skins and have the white spots on the upper wing-coverts smaller than the average. They are nearly topotypical but nevertheless seem to be slightly less distinct from *cinerascens* of eastern Ecuador than are the Ucayali skins. This approach, taken in conjunction with certain variations toward *sclateri*, shown by numerous examples of *cinerascens*, and the general resemblance of these forms in both sexes, indicate a relationship which is close enough to warrant their consideration as conspecies. Additional notes on this point are given in the discussion of *cinerascens*.

There are two records of *sclateri* from north of the Amazon but both are considered unreliable by Hellmayr who has examined the specimens

in question. One is a male from "Iquitos" in the Berlepsch collection at Frankfort (ex Hahnel collection); the other is a mounted female from "Pebas" in the Paris Museum (ex Castelnau and Deville collection). All other recorded skins from Perú north of the Amazon (Pebas) appear to belong to typical *cinerascens*. Other records of *sclateri* are from Yurimaguas, Sarayacu, between Moyobamba and Xeveros (=Jeberos), Moyobamba, and "upper Ucayali."

Ceromacra cinerascens iterata, new subspecies

TYPE from Caxiricatuba, Rio Tapajoz (right bank), Brazil. No. 286,595, American Museum of Natural History. Adult female collected May 8, 1931, by A. M. Olalla.

DIAGNOSIS.—Similar to *C. c. sclateri* of Perú south of the Amazon, but males usually paler gray, especially below. Females like those of *sclateri* but somewhat paler above and below and with the uropygium of the same olivaceous brown color as the mantle, not grayish; under wing-coverts more purely white; tail with a little more olivaceous tone, strongest on the lateral margins, and with a more pronounced blackish area subterminally (in ventral aspects more sharply contrasting with the main portion of the feathers).

RANGE.—Eastern Brazil in the basin of the Amazon south of that stream from western Maranhão west at least to the Rio Madeira and northern Matto Grosso.

DESCRIPTION OF TYPE.—Top ot head mainly light Brownish Olive; forehead slightly lighter; mantle, rump, and upper tail-coverts dark Buffy Olive; lower part of mantle with a large, concealed patch of white subbasally, separated from the olive tips by a grayish or dusky area. Lores buffy white at base, olivaceous at tips; auriculars with olive borders and buffy shaft-stripes; entire under part of body brownish Isabella Color, darker laterally, paler on the middle of the belly, and slightly paler on the throat; thighs olive; under tail-coverts Light Brownish Olive with very narrow whitish tips. Wings dark brown with more olivaceous outer margins; greater upper wing-coverts brownish olive with brighter outer margins and small, triangular spots of white at the tips; lesser and median series more grayish with some olive tinge on the margins and with broader, triangular spots of white at tips preceded by an inconspicuous, dusky subterminal area; bend of wing with a small white patch; under wing-coverts and inner margins of remiges whitish. Tail graduated (for 22 mm.), dull grayish olive with white tips, narrowest (1 mm.) on innermost pair, broadest (8 mm.) on outermost pair. Maxilla black (in dried skin); mandible dull whitish; feet black. Wing, 61.5 mm.; tail, 63.5; exposed culmen, 16; culmen from base, 19; tarsus, 20.

REMARKS.—Males vary from Slate-Gray to Slate Color above with a variable amount of subterminal blackish visible on the mantle; mantle with an extensive white patch concealed near the bases of the feathers; lores paler gray or whitish basally; sides of head and under parts Dark Gull Gray to Slate-Gray. Wings sooty black, with exterior margins gray except on outer primary where this margin is whitish; upper wing-coverts blackish wtih triangular white spots at tips; radial margin of

wing with an extensive white area; under wing-coverts white at base of quills, otherwise dull grayish; inner margins of remiges white. Tail dark gray with broad white tips as in the female. Bill entirely black; feet black. Wing, 62–68.5 mm.; tail, 62–70; exposed culmen, 16–18; culmen from base, 20–21.75; tarsus, 19.5–21.75.

Only one male, from Igarapé Brabo, Rio Tapajoz, is as dark as the lightest Peruvian birds. It is further distinguished by having unusually large white spots on the upper wing-coverts and the rectrices.

Two females have the middle and lesser upper wing-coverts browner than in the type. There is also some variation in the size of the spots on the wing-coverts.

Young males are darker and duller above than adult females and have the rump inclined to grayish, at least subterminally, resembling females of *sclateri*. The white patch on the mantle is more extensive than in adult females.

The pale coloration of the eastern males was noted by Hellmayr in various papers on birds from Pará, Rio Tapajoz, and the Rio Madeira, though on the latter stream part of the males were found to be dark like the Peruvian *sclateri*. Skins from Teffé and the Rio Purús also were noted as dark like *sclateri*. Probably the line of demarcation between *sclateri* and *iterata* exists in the neighborhood of the Rio Madeira. Two males from Matto Grosso (Barão Melgaço and Morinha Lyra) are paler than any of the fresher skins from the Tapajoz and, though evidently somewhat faded, are certainly referable to *iterata* rather than to *sclateri*. No other specimens from that region are at hand for comparison.

Cercomacra cinerascens cinerascens (Sclater)

Formicivora cinerascens Sclater, 1857, P. Z. S. London, XXV, p. 131—part (type); fl. Napo (eastern Ecuador); British Mus.

Found in Perú only north of the Amazon; recorded only from Pebas. I have no Peruvian skins. Two Ecuadorian skins from the Napo at the mouth of the Curaray are topotypical and others from the Río Suno are practically so, agreeing with the Curaray examples.

These birds are all recognizably distinct from *sclateri* in their paler coloration and in the absence of the large white shoulder patch and of the prominent white spots at the tips of the upper wing-coverts, but these white marks are frequently present in a modified degree. Furthermore, the white tips of the rectrices are sometimes smaller than in *sclateri*, but there is frequent agreement. The females of *cinerascens* have the uropygium distinctly grayish in noticeable contrast to the mantle, as do

the females of *sclateri*, and thereby differ from the females of *iterata*, described above.

A few females from Faro, Rio Jamundá, Brazil, and one of the same sex from British Guiana agree with *iterata* in the possession of an olive-brown rump, thereby differing from *cinerascens* exactly as *iterata* differs from *sclateri*. On the other hand they differ from *iterata* exactly as *cinerascens* differs from *sclateri*, by the merely casual, instead of pronounced, development of white on the upper wing-coverts. For these northeastern skins there is an available name in *immaculata* Chubb, based on birds from British Guiana. This form, I think, may be recognized on the characters mentioned herewith. The white patch on the mantle reaches its minimum development also in *immaculata* but, as pointed by Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, pt. 3, p. 214, footnote *a*, 1924), this character is variable. Both *cinerascens* and *immaculata* have less white on the mantle than *sclateri* and *iterata*. Males from Faro are not separable from Ecuadorian males; the separation of the subspecies rests in the females.

Females from the upper Rio Negro, Brazil, and from western Venezuela, in the vicinity of Mt. Duida and the upper Orinoco, occasionally show some brownish coloration on the lower back though it is not so uniform with the mantle as in the more eastern skins. Most of them are not distinguishable from Ecuadorian examples.

So far as my material and available records go, there is no evidence of the occurrence of the species on the lower Rio Negro or the Rio Branco, which makes an apparent break between the ranges of *cinerascens* and *immaculata* in this region. The break may not exist in nature, in which case the resident birds should be largely intermediate between the two adjacent forms. I believe the records of *immaculata* from Faro, given herewith, exhibit an extension of the known range of the species.

SPECIMENS EXAMINED

C. c. cinerascens.—ECUADOR: mouth of Río Curaray, 1 ♂, 1 ♀; Río Suno, above Avila, 2 ♂, 2 ♀; lower Río Suno, 2 ♂, 1 ♀; below San José, 1 ♂. COLOMBIA: Florencia, Caquetá, 1 ♂, 1 ♀; Andalucia, 1 ♂. VENEZUELA: La Unión, Río Caura, 1 ♂; vicinity of Mt. Duida (Río Cassiquiare, Río Orinoco, etc.), 15 ♂, 9 ♀. BRAZIL: San Gabriel, Rio Negro, 1 ♂; "Inenby," 1 ♂; Santa Isabel, 1 ♂, 1 ♀; Tatú, 1 "♂" [= ♀]; Yucabi, 1 ♀; Mt. Curycuryari, 1 ♀.

C. c. immaculata.—BRITISH GUIANA: Kamakusa, 1 ♀. BRAZIL: Faro, Rio Jamundá, 2 ♂, 1 ? [= ♂], 3 ♀.

C. c. sclateri.—PERÚ: Río Seco, west of Moyobamba, 1 ♂, 1 ♀; Santa Rosa, upper Ucayali, 3 ♂, 2 ♀; Lagarto, 3 ♂, 5 ♀; mouth of Río Urubamba, 1 ♂; Astillero, 1 ♂.

C. c. iterata.—BRAZIL: Caxiricatuba, Rio Tapajoz, 1 ♂, 2 ♀ (incl. type); Piquiatuba, 3 ♂, 2 ♀; Igarapé Brabo, 4 ♂, 3 ♀; Tauary, 1 ♂; Igarapé Amorín, 1 ♂; Baião, Rio Tocantins, 1 ♂, 1 ♀; Igarapé Auará, Rio Madeira, 1 ♂; Barão Melgaço, Matto Grosso, 1 ♂; Morinha Lyra, 1 ♂.

NOTE

Cercomacra nigrescens and *C. serva*, the two remaining species of the genus with Peruvian representatives, have been discussed in an earlier paper, American Museum Novitates, No. 500, pp. 11–16, 1931.

Phlegopsis nigro-maculata nigro-maculata (D'Orbigny and Lafresnaye)

M(yothera) nigro-maculata D'ORBIGNY AND LAFRESNAYE, 1837, Mag. Zool., VII, cl. 2, p. 14—Guarayos, e. Bol(ivia); Paris Mus.

Twenty-six specimens from the Ucayali, Perú, three from Teffé, Brazil, and three from Bolivia agree very well among themselves. One of the Bolivian specimens (from the lower Beni) shows a slight approach toward *P. n. bowmani* of the Rio Madeira and Rio Tapajoz by having a greater amount of white on the shoulder, but it remains much closer to *nigro-maculata*. *P. n. nigro-maculata* apparently ranges eastward to the left bank of the Madeira but is replaced on the right bank by *P. n. bowmani*. This form then extends eastward from the right bank of the Madeira to the right bank of the Tapajoz and probably beyond to the left bank of the Xingú. To the eastward of the Tocantins and in Maranhão the good form, *P. n. paraensis*, exists. Between the Xingú and the Tocantins, however, the birds of this species are like neither *bowmani* nor *paraensis* but exhibit greater resemblance to *nigro-maculata*, with certain differences from it also. This subspecies appears to have no available name and I describe it, therefore, as new.

The only records of *nigro-maculata* from Perú are from the Ucayali; there are none from southeastern Perú, although the species should reach that part of the country from Bolivia. There are specimens in the British Museum said to be from Ecuador (Río Napo) but the collectors are unknown and the species appears not to have been found there by recent workers.

Phlegopsis nigro-maculata confinis, new subspecies

TYPE from Tapará, Rio Xingú (right bank), Brazil. No. 429,536, American Museum of Natural History. Adult male collected August 30. 1931, by A. M. Olalla.

DIAGNOSIS.—Very like *P. n. nigro-maculata* of Perú and Bolivia but noticeably smaller; rump and upper tail-coverts more strongly spotted with blackish; upper part of mantle adjoining hind neck distinctly spotted with black and usually with white or buffy white spots at the tips of the feathers; tail with heavier black sub-

terminal spots; black of belly prolonged slightly farther posteriorly; bare circum-ocular space larger, reaching base of bill at commissure. Much less rufescent above than *P. n. paraensis;* back grayer than in *P. n. bowmani,* with smaller, narrower (less transverse), and more sharply defined blackish spots.

Range.—East bank of the Rio Xingú, Brazil (possibly eastward to the left bank of the Tocantins ?).

Description of Type.—Whole head, neck, breast, and sides black except for a large denuded patch surrounding the eye and extending from the base of the commissure anteriorly to a point above the posterior end of the auriculars (but the base of the maxilla and both eyelids are narrowly feathered); whole mantle Light Brownish Olive x Buffy Brown, each feather with an obovate black spot, longer than broad, near the tip, sharply defined and made more prominent by the brightening of the general ground color immediately adjacent, especially terminally; the brighter border on the feathers of the uppermost part of the mantle is still broader and lighter, forming a whitish tip to the feathers; lower back and rump marked like the mantle but with the dark spots smaller and a little obscured; upper tail-coverts bright Chestnut, unmarked except for slight blackish borders on some of the smallest basal ones; flanks and lower belly dark Saccardo's Umber; thighs darker and more grayish or dusky; under tail-coverts Sanford's Brown x Burnt Sienna, a little duller anteriorly. Tail Bay x Chestnut with shafts black from the ends of the upper coverts to within 4 or 5 mm. of the tip, with the last few millimeters of the black line expanded to form a sagittate, subterminal spot on each feather.

Upper wing-coverts colored and marked like the mantle except that the black spots are extended basally along the shafts to form a broad stripe on each feather; outermost greater coverts strongly tinged with rufescence; alula largely black but with inner margin of longest feather and both margins of others ferruginous; margin of wing from scapular region to base of primaries with prominent white borders on the feathers; under wing-coverts olive-grayish, with white shaft-stripes on many of the feathers near the bend of the wing. Remiges exteriorly Burnt Sienna x Auburn, rather dusky on terminal part of inner webs (except of the tertials) and with prominent black subterminal spots which are very large on the tertials, smaller and less conspicuous on the secondaries (where the inner edge of the spot on each feather merges with the dusky portion of the inner webs), and inconspicuous on the primaries. Bill and feet black (in dried skin). Wing, 86 mm.; tail, 54.25; exposed culmen, 17; culmen from base, 20.75; tarsus, 28.5.

Remarks.—Female like the male. The four sexed males have the wings: 84.25, 86, 87, 90 mm.; tail, 52.5, 54.25. 54, 59; female: wing, 86; tail, 53. In *nigro-maculata* the males have the wings, 91–97 mm.; tail, 58–65; females: wing, 88–96; tail, 54–62.

The black spots on the tail are present in all the specimens of the series and are much larger in some of the skins other than the type. The upper tail-coverts are sometimes more heavily marked with blackish than in the type and in one male even the under tail-coverts have small blackish shaft-spots. This specimen has the pale spots on the upper mantle particularly clear white.

Whether the record from Cametá (left bank of Rio Tocantins) belongs here or with *paraensis* can not be determined without the specimen.

Specimens Examined

P. n. nigro-maculata.—Bolivia: lower Río Beni, 1 ♂; Todos Santos, 2 ♀. Perú: Lagarto, upper Ucayali, 8 ♂, 2 ♀; Santa Rosa, upper Ucayali, 3 ♂, 3 ♀; Sarayacu, 6 ♂, 4 ♀. Brazil: Teffé, 3 ♂.

P. n. bowmani.—Brazil: Borba, 1 ♀; Igarapé Auará, 2 ♂; Villa Bella Imperatríz, 8 ♂, 4 ♀; Santarem, 2 ♂, 3 ♀; Boim, 1 ♀; Igarapé Amorín, 1 ♂; Piquiatuba, 1 ♂; Limoãl, 1 ♂; Caxiricatuba, 1 ♂; Igarapé Brabo, 5 ♂, 3 ♀.

P. n. confinis.—Brazil: Tapará, Rio Xingú, 3 ♂ (incl. type), 2 (?); Porto do Moz, 1 ♂; Villarinho do Monte, 1 ♀.

P. n. paraensis.—Brazil: Baião, Rio Tocantins, 2 ♂, 2 ♀, 1 (?); Mocajuba, 2 ♂; Sta. Maria de Miguel, Rio Guamá, 1 ♀; Providencia, 1 ♂.

Phlegopsis erythroptera ustulata Todd

Phlegopsis erythroptera ustulata Todd, 1927, Proc. Biol. Soc. Wash., XL, p. 175—Arimã, Rio Purús, Brazil; ♀; Carnegie Mus.

A male from Lagarto, upper Ucayali, represents the first record of the species from south of the Amazon in Perú. A male from Rosarinho, Rio Madeira (left bank), Brazil, agrees well with it. Both specimens have narrow rufous tips on the upper tail-coverts and the Rosarinho skin shows rufous tips also on the rectrices, though it is fully adult.

Phlegopsis erythroptera erythroptera (Gould)

Formicarius erythropterus Gould, 1855, Ann. Mag. Nat. Hist., (2), XV, p. 345—"Interior of Demerara" (errore, Rio Negro suggested by Hellmayr, 1924).

No material is at hand from Perú north of the Amazon where the typical form should occur. Taczanowski ('Orn. Pér.,' II, p. 553, 1884) recorded a specimen from Iquitos, collected by Blasius, which probably represents this form if the locality is correct. If the specimen was taken across the Amazon from Iquitos it should belong to *ustulata*. Unfortunately Taczanowski's description of the male plumage, presumably drawn up from this specimen, is not explicit enough to permit definite assignment to one subspecies or the other. The skin apparently has the upper tail-coverts tipped with rufous but whether broadly (=*erythroptera*) or narrowly (=*ustulata*) is not specified.

Since *erythroptera* occurs in eastern Ecuador, however, its occurrence in Perú north of the Amazon is to be expected and Taczanowski's reference may be left here pending re-examination of the Blasius skin, now in the Brunswick Museum.

SPECIMENS EXAMINED

P. e. erythroptera.—BRAZIL: Tatú, Rio Negro, 2 ♂; Mt Curycuryari, 1 ♀. VENEZUELA: Solano, Río Cassiquiare, 1 ♂, 1 ♀; Caño León, Mt Duida, 1 ♂. COLOMBIA: La Morelia, 1 ♀. ECUADOR: lower Río Suno, 2 ♂, 1 ♀.

P. e. ustulata.—BRAZIL: Rosarinho, Rio Madeira, 1 ♂. PERÚ: Lagarto, upper Ucayali, 1 ♂.

AMERICAN MUSEUM NOVITATES

Number 557 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Sept. 12, 1932

59.9, 32 C (8)

THE SOUTH AMERICAN CRICETIDÆ DESCRIBED BY FELIX AZARA

BY G. H. H. TATE

Because of the scientific names given them by Desmarest and Fischer, the mice whose descriptions were so meticulously recorded by Azara in his 'Essais' (1801)[1] and his 'Apuntamientos' (1802)[2] are to be reckoned among the key species in systematic work among the South American Cricetidæ. For this reason it has been thought desirable to draw up a careful analysis of the forms and to set forth any conclusions that can be reached regarding them, in the light of modern nomenclatorial standards.

Four points stand out: (1) Azara used no scientific names; (2) in his two editions he used in most cases different common names for the same animal; (3) he described certain forms in the 'Apuntamientos' which were omitted from the 'Essais'; and (4) besides Paraguay his localities include Uruguay and the region well to the south of Buenos Aires.

The two authors[3] who applied binomials to Azara's descriptions used in every case the generic blanket-namè *Mus* followed by a specific name, usually derived from Azara's local name. The intention of the present inquiry is (1) to compare the species of Azara's two works and (2) to attempt to ascertain where, in the modern system of genera, Azara's mice should be placed.

The following is a list of genera which occur, or may reasonably be inferred to occur, in the region worked by Azara:

Reithrodon	*Scapteromys*
Graomys	*Oryzomys*
Eligmodontia	*Œcomys ?*
Hesperomys	*Rhipidomys*
Holochilus	*Akodon*
Nectomys	*Oxymycterus*

[1] 'Essais sur l'Histoire Naturelle des Quadrupèdes de la Provincia du Paraguay,' II, Paris.
[2] 'Apuntamientos, para la Historia Natural de los Quadrúpedos del Paraguay y Rio de la Plata,' Madrid.
[3] Desmarest worked only with the 'Essais' and his names in 'Nouveau Dict. d'Hist Nat.,' 1819, XXIX, refer particularly to that work; Fischer named two species of the 'Apuntamientos' in his 'Synopsis Mammalium,' 1829.

For convenience I have considered Azara's rats in the order used in the 'Essais,' adding afterwards the three species which are described only in the 'Apuntamientos.' If full descriptions are desired, the original works must be consulted, but when any marked divergence is apparent in the descriptions, I have placed those parts of the French and Spanish versions in left and right parallel columns under each species. The colloquial names used by Azara are printed in small capitals.

Mus cephalotes Desmarest

(Based upon the French Edition)

NAME.—RAT SECONDE OU RAT A GROSSE TÊTE	No. XLVII.—COLA IGUAL AL CUERPO
COLOR.—Brown from muzzle to tail; sides of body and head brighter, with a touch of cinnamon	A mixture of dark and plumbeous, and the tips cinnamon brown. Fur quite long, 6–8 lines

The description of *cephalotes* in general, its 27 mm. hind foot, cinnamon-brown color, and tail equal in length to body, appear to fit the genus *Oryzomys* closely. *Holochilus*, the only other possibility, has the hind foot at least 1½ inches (38 mm.) in length.

Mus angouya Desmarest

(Based upon the French Edition)

NAME.—RAT TROISIÈME OU ANGOUYA	No. XLVIII.—ANGUYA
COLOR.—Tarsus . . . olive . . .	Tarsus . . . brownish (trigueño) . . .

In *angouya* we are again no doubt dealing with *Oryzomys*. Azara himself doubted the distinctness of this form from *cephalotes*. While the animal is considerably larger in size than *cephalotes*, the 30 mm. hind foot again precludes its being a *Holochilus*. Its color was quite bright cinnamon.

Mus auritus Desmarest

(Based upon the French Edition)

NAME.—RAT QUATRIÈME OU RAT OREILLARD	No. XLV.—OREJON
PLACE.—Pampas, south of Buenos Aires.	(p. 85). At 36° [about 100 miles south of city of Buenos Aires] I caught one with truncated tail. Note.—The OREJON was described from a larger specimen from 32½° [latitude of Entre Rios]. The measurements differ, but the descriptions tally fairly closely

I have previously concluded[1] that *auritus* was a *Reithrodon*. Azara's description of its very large head, ears, and eyes, as well as its dimensions and coloration, seems conclusive.

Mus rufus Desmarest

(Based upon the French Edition)

NAME.—RAT CINQUIÈME OU RAT ROUX	No. XLIV.—HOCICUDO
PLACE.[2]	Taken (shot) in an arroyo at 32½° [latitude of Entre Rios]
PELAGE.[2]	Short, 5 lines on the back, rather rough.
COLOR.[2]	Very dark from nose to tail, but in the tips distinctly cinnamon. Sides of body and jaw and outer surfaces of limbs bright cinnamon. So also underparts, but more whitened

The following is taken from the description upon which *rufus* was based.

COLLECTOR.—My friend Noseda sent one in brandy, where it remained forgotten several months. The liquor had run out... (p. 96). I think these colors were rather altered by the brandy	My friend Noseda caught one on the bank of a stream and sent it to me in spirit. I received it much disfigured but could not doubt it was the same species. . . .

In *rufus* we have apparently an *Oxymycterus* which had been kept in spirit and then dried out. If Azara was right in his assertion that Noseda's animal was the same species as that which he himself shot in the latitude of 32½° S. [Entre Rios], then *rufus* is a species with dark dorsal parts, bright cinnamon sides and limbs, and whitish underparts. No tarsal length was given. Azara, writing of the RAT ROUX, said (p. 94) that he had seen only the one which he was describing, and that "the muzzle did not appear so acute as that of the common rat"; whereas he named his HOCICUDO "for the length and acuteness of the nose"; and had he not referred (p. 82) also to the specimen caught by Noseda, one would scarcely think them the same. The only possible alternative genera are *Scapteromys* and *Holochilus*, to neither of which, in my opinion, the description conforms.

Mus nigripes Desmarest

(Based upon the French Edition)

NAME.—RAT SIXIÈME OU RAT A TARSE NOIR	No. XLIX.—COLILARGO
EAR.—(Description in part omitted)	Full description
COLOR.—Tarsus . . . colored inky black	As dark as ink beneath

[1]Amer. Mus Novit., 1932, No 529.
[2]This specimen, upon which "Hocicudo" was based, was not mentioned in the French edition.

Nigripes appears to have been a small brown *Oryzomys*—possibly an *Oligoryzomys*—with tail slightly longer than body. The species should be identifiable.

Mus laucha Desmarest

(Based upon the French Edition)

NAME.—RAT SEPTIÈME OU LAUCHA	No. LI.—LAUCHA
PLACE.—Two in garden at Buenos Aires and one in pampas	All small mice are so named at Buenos Aires and Montevideo
MEASUREMENTS.—Total length 4″; tail $1\frac{3}{4}''$.	Total length $4\frac{3}{4}''$; tail 2″ . . . .
VIBRISSÆ.	Very long
COLOR.—Upper parts plumbeous as in common rat, but with some difference	Upper parts mixed dark and cinnamon
FEMALES.—I have a female $3\frac{3}{4}''$ long and another 3″ long	In a female taken January 22, I found 6 embryos . . . .

The very small size of *laucha* indicates either *Hesperomys* or *Eligmodontia*. From the rather short tail I am inclined to choose *Hesperomys*.

The following three species were not included in the 'Essais' and consequently escaped the attention of Desmarest. In 1829, however, J. B. Fischer named two of them in his 'Synopsis Mammalium,' so that only one of all Azara's mice, the COLIBREVE, escaped being given a special scientific name. I give below a translation of portions of the descriptions:

No. LXVI.—COLIBREVE

. . . I have seen only the present one, which the dogs caught in the fields of Montevideo. . . . Length $6\frac{1}{2}$ inches; tail $2\frac{1}{4}$ and appearing quite slender. . . . Tarsus 9 lines with the claw, and dark beneath. . . . All lower parts pearl-colored, the remainder dark, but the tips of the hairs are lighter and reduce the dark color.

This rat, to which neither Desmarest nor Fischer gave a name, appears referable either to *Akodon* or to young *Oxymycterus*. I am inclined to select *Akodon* as probably the genus, in which case it is in all likelihood referable to *A. obscurus* Waterhouse of Uruguay.

No. L.—AGRESTE [field mouse]

. . . two identical [specimens] in $30\frac{1}{2}°$ (latitude of Entre Rios) . . . it is a field mouse. . . . Length $6\frac{1}{4}$ inches; tail $2\frac{5}{8}$. . . . The tarsus measures 9 lines with claw and is whitish . . . the pelage is 4 lines long and that of the head, upper parts and sides is mixed dark and cinnamon, the tips being of the latter color. In the under parts is a dull whitish which reaches a little on to the sides. Tail dark.

Fischer in 1829 (p. 325) applied the names *Mus?* (*sic*) *azaræ* to the AGRESTE.

I am inclined to consider this description, which fits no other genus very closely, that of an *Akodon.*

No. LII.—Blanco debaxo

. . . I killed two identical [specimens] under two hides stretched in a garden at 30½° (latitude of Entre Rios) . . . undoubtedly a field mouse . . . I describe it with the former [*laucha*] before me . . . length 5 inches; tail 1$^{11}/_{12}$ . . . tail shorter than in the former [*laucha*] . . . The fur is more appressed, soft, fine and short, white on the under parts, and the rest a mixture of dark and whitish, with less cinnamon than that mentioned; but on the sides white dominates. . . . Tarsus 8 lines with claw, and white beneath.

Fischer in 1829 (p. 326) applied the name *Mus ? (sic) dubius* to the Blanco debaxo.

This animal can scarcely be fitted into any genus except *Hesperomys* (in restricted sense). Azara himself compared it with *H. laucha* and among other contrasts noted its shorter tail. We may then write instead of *Mus dubius* Fischer, *Hesperomys dubius* (Fischer).

In my opinion Azara described 1 *Reithrodon* (*auritus* Desmarest), 2 *Hesperomys* (*laucha* Desmarest, *dubius* Fischer), 3 *Oryzomys* (*cephalotes* Desmarest, *nigripes* Desmarest and *angouya* Desmarest), 2 *Akodon* (Colibreve and *azaræ* Fischer), and 1 *Oxymycterus* (*rufus* Desmarest). When his descriptions are carefully checked against present-day concepts of these genera, there is little difficulty in most cases in determining to which genus a given description belongs. It is difficult to understand how he failed to obtain such large forms as *Nectomys* and *Holochilus.*

The general conclusions reached, based upon the foregoing discussion, may be set forth in tabular form:

'Essais'	'Early Scientific' Name	'Apuntamientos'	Probable Modern Genus
Rat seconde ou Rat a grosse tête	*Mus cephalotes* Desmarest	Cola igual al cuerpo	*Oryzomys*
Rat Troisième ou Angouya	*Mus angouya* Desmarest	Anguya	*Oryzomys*
Rat quatrième ou Oreillard	*Mus auritus* Desmarest	Orejon	*Reithrodon*
Rat cinquième ou Rat roux	*Mus rufus* Desmarest	Hocicudo	*Oxymycterus*
Rat sixième ou Rat a tarse noir	*Mus nigripes* Desmarest	Colilargo	*Oryzomys*
Rat septième ou Laucha	*Mus laucha* Desmarest	Laucha	*Hesperomys*
		Colibreve	*Akodon*
	Mus azaræ Fischer	Agreste	*Akodon*
	Mus dubius Fischer	Blanco debaxo	*Hesperomys*

AMERICAN MUSEUM NOVITATES

Number 559 — Published by The American Museum of Natural History, New York City — Sept. 14, 1932

59.57,72 C (88)

NEW SPECIES OF CALOBATIDÆ FROM BRITISH GUIANA

By C. H. Curran

The species described in the following pages were collected by the New York Zoölogical Society staff at Kartabo, British Guiana. The types are in The American Museum of Natural History.

Rainieria Rondani

There is one species in the collection. The following table separates the American species.[1]

Table of Species

1.—Wings unicolorous, pale luteous or brownish-gray........................2.
Wings hyaline with brown spots or bands....................................4.
2.—Abdomen yellowish...3.
Abdomen brown..*mulleri* Enderlein.
3.—Posterior basitarsus yellow on basal half..................*garleppi* Enderlein.
Posterior basitarsus brown.................................*hoffmannsi* Enderlein.
4.—Thorax reddish or yellow...5.
Thorax black or brown in ground color.......................................8.
5.—Posterior femora reddish or yellowish, with brown bands.....................6.
Posterior femora brown with white bands....................*versicolora* Enderlein.
6.—Wings with more than one band or largely brown with hyaline areas........7.
Wings with a large, triangular brown band near apical fourth.
unifasciata Fabricius.
7.—Wings with three brown bands, the third preapical..........*fasciata* Fabricius.
Wings brown on apical half, with pale roundish spots.......*perforata* Enderlein.
8.—Ground color of mesonotum not concealed by yellowish pollen..............9.
Ground color of mesonotum concealed by yellowish pollen..*strophium* Enderlein.
9.—Abdomen black or brown..10.
Abdomen reddish..*rufiventris* Enderlein.
10.—Femora brown or black, the base sometimes more or less yellowish..........11.
Femora brown or black, with whitish yellow bands, the apex very broadly reddish, or largely reddish...14.
11.—Anterior tarsi not wholly white..12.
Anterior tarsi wholly white...................................*soccata* Enderlein.
12.—Front tarsi wholly blackish..13.
Front tarsi with the basal segment more than half whitish..................18.
13.—The hyaline band at the apical third of the wing reaches the costa.
orcina Wiedemann.

---

[1]Since the preparation of this key Cresson has described two species from Colombia and Central America.

The hyaline band does not reach beyond the second vein..................18.
14.—Femora with one or more pale bands..............................15.
Femora brown, the apical fourth reddish..................*postica*, n. sp.
15.—Coxæ brown..16.
Front coxæ yellow...19.
16.—Front tarsi wholly white or yellow.................................17.
Apical segments of front tarsi brown..............*tritæniolata* Enderlein.
17.—Apex of wing brownish.....................*paraguayensis* Enderlein.
Apex of wing hyaline.............................*wiedemanni* Enderlein.
18.—Wings brownish, with two hyaline spots.................*biguttata* Enderlein.
Wings brownish with one hyaline spot..................*guttata* Enderlein.
19.—All the coxæ yellow (North America)...............................20.
Posterior coxæ brown..............................*peruana* Enderlein.
20.—Basal segment of hind tarsi white-haired above.............*antennæpes* Say.
Basal segment of hind tarsi wholly black-haired.....................species.

Rainieria postica, new species

Black, the wings trifasciate; all the tarsi whitish basally. Length, 9 mm.

FEMALE.—Face and front reddish, the head elsewhere reddish brown, whitish pollinose, the front without pollen except on the large reddish median spot, the upper orbits shining except on the large upper inner corner. Postocellars present; two pairs of anterior frontals, the front with obscure hair. Antennæ brownish, the base of the third segment reddish, the arista yellow basally. Clypeus brownish.

Thorax gray pollinose, the mesonotum brown on posterior half except a weak prescutellar fascia, between the humeri weakly brownish. One pair of dorsocentrals; scutellars erect; hair of pleura black. Pleura with two oblique dark vittæ.

Legs black, the apical fifth of the femora reddish; front tarsi wholly white, the basal segment of the middle and basal two of the posterior tarsi whitish, the pale segments of the posterior tarsi with brown tips.

Wings cinereous hyaline, the basal brown band entire, moderately broad, extending back from the apical portion of the subcostal cell; second band broad, its apical margin almost straight, slightly oblique, rising anteriorly just before the tip of the second vein and extending back to the tip of the fifth vein, its inner edge produced toward the base of the wing on the median portion but not reaching the base of the apical cell, apex of wing broadly brownish in front of the fourth vein.

Abdomen gray pollinose, each segment with a large band of brownish occupying more than the posterior half, the apices of the segments gray.

TYPE.—Female, Kartabo, May 10, 1924.

PARASPHEN Enderlein

Parasphen amazonicus ruficauda, new variety

Two males and one female, Kartabo, March 26, 27, and May 28, 1924.

These specimens agree with the description of *P. amazonicus* Enderlein except that the apex of the abdomen and the genitalia of the male are reddish and the ovipositor of the female is reddish yellow.

TYPES.—Male, March 26; allotype, female, May 28.

GRALLOMYIA Rondani

The species in the collection are separable by the following key.

TABLE OF SPECIES

1.—	Thorax black in ground color	3.
	Thorax reddish or yellowish	2.
2.—	Mesonotum with two black spots in front	*testacea* Fabricius.
	Mesonotum without black spots in front	*luridilabris* Enderlein.
3.—	At least one pair of dorsocentrals	4.
	No dorsocentrals	*tarsata* Wiedemann.
4.—	One pair of dorsocentrals	5.
	Two pairs of dorsocentrals	*parens* Cresson.
5.—	Middle femora not white at base	6.
	Middle femora broadly white at base	7.
6.—	Posterior tarsi white at base	*livida* Cresson.
	Posterior tarsi wholly black	*annulata* Fabricius.
7.—	Posterior femora whitish yellow with three narrow brown bands.	*alicia*, n. sp.
	Posterior femora black with two whitish bands	*velutina*, n. sp.

Grallomyia alicia, new species

Black; femora with three brown bands, the anterior pair with two; wing with a median, semilunular brown spot and the apex pale brown. Length, 7.5 mm.

Front dull yellow, the vertex with a large, subtriangular shining brownish-red spot on either side; frontal spot rusty reddish, blackish at the ocelli. Facial grooves, clypeus, and apex of proboscis brown, the palpi blackish with the lower border yellow on apical half. Face, sides of clypeus, posterior orbits and a broad stripe behind the ocelli, white pollinose. Postocellar bristles as long as verticals and forming a straight line with them; outer verticals weaker and divergent. Antennæ reddish yellow, the arista black except basally.

Mesonotum brownish pollinose, on either side with a sublateral, broad, irregular, yellow pollinose vitta which turns sharply outward in front to cover the humeral depression and extends over the posterior calli; the pleura bear three slightly oblique white pollinose vittæ, the anterior two of which unite on the pectus, the median one yellow on the mesopleura. One pair of dorsocentrals; hair of dorsum yellowish brown, obscure, of pleura whitish, the sternopleural fringe black; propleural hair and pectoral bristles, yellowish; scutellum with half a dozen hairs at most.

Front coxæ mostly reddish. Femora yellow, the apical fifth of the posterior four brownish red, preceded by a narrow, oblique brown band, the femora with an oblique brown band at basal and apical third; anterior femora with a broad, incomplete brown band at the basal third and another occupying the apical fourth, the two connected along the anterior surface. Front tarsi wholly white, the others yellowish brown; tibiæ brownish, the middle pair obscurely reddish on apical half.

Wings cinereous hyaline. The median brown cloud does not extend forward as far as the second vein and only obscurely reaches to the posterior margin at the end of the fifth vein, its outer edge concave, the inner border convex; sometimes more subtriangular in shape and not reaching the posterior border; the apical cloud is weak, sometimes almost obsolete.

Abdomen shining black; the first segment, apical half of second and narrow base of third, white pollinose; basal half of second and the third segment, brown pollinose. Hair black. Ovipositor long. Fifth sternite of male with the arms separated by V-shaped excision.

TYPES.—Holotype, female, Kartabo, 1924, (No. 24728), allotype, male, British Guiana, February 12, 1914, (H. S. Parish). Paratypes: three females, Kartabo, 1924, one of them May 23, (4276).

The male is teneral and the wing-markings are scarcely evident.

Grallomyia velutina, new species

Related to *tarsata* Wiedemann but the middle tibiæ are broadly white basally, there is no pollen on the front, and the abdomen is differently colored. Length, 9 mm.

FEMALE.—Front black, the upper orbits shining, the anterior fifth shining reddish; black frontal spot large, cordate, produced backward to the vertex, with whitish sheen in some lights. Face reddish, the antennal grooves black; occiput brown, whitish pollinose; palpi yellowish, brownish on basal half; proboscis brown. Postocellar bristles absent. Antennæ missing.

Thorax as in *tarsata* but with one pair of dorsocentrals and without hairs on the scutellum.

Legs as in *tarsata* except that there is a broad basal white ring on the middle femora, and the tarsi are yellow with the basal segment white.

Abdomen with steel-blue reflections, the basal half of the second and whole of the third and fourth segments dull black, the first and apical half of the second rather thickly white pollinose.

TYPE.—Female, Kartabo, March 3, 1924.

AMERICAN MUSEUM NOVITATES

Number 560 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Sept. 16, 1932

59.9, 32 M (728.1)

THREE NEW *REITHRODONTOMYS* AND TWO NEW *PEROMYSCUS* FROM GUATEMALA

BY GEORGE G. GOODWIN

This is the second preliminary report on the mammals recently collected by Mr. A. W. Anthony in Guatemala for The American Museum of Natural History. In this collection there is a large series of several species of harvest mice and white-footed mice, five of which are hitherto undescribed forms.

My thanks are due to Major E. A. Goldman and Mr. A. H. Howell for kindly comparing these specimens with the large series in Washington and commenting upon their relationships.

Reithrodontomys mexicanus howelli, new subspecies

TYPE.—No. 70500, Amer. Mus. Nat. Hist.; female, adult; Chichicastenango (Santo Tomas) District of El Quiché, Guatemala; 6500 feet elevation; February 12, 1925; collector, A. W. Anthony. The type is a skin and skull in good condition.

GENERAL CHARACTERS.—Size small, tail long, concolor except tip which is pure white; ears short, color nearly uniform cinnamon above, white below; hind feet, ears, and tail dark.

DESCRIPTION.—Fur rather long, soft and full. Color[1] of upperparts cinnamon sparsely darkened on back with blackish hairs, becoming cinnamon-brown on mid-dorsal area; cheeks, sides of shoulders and flanks bright pinkish cinnamon; a blackish ring around eye; tail nearly unicolor, fuscous above, only a shade paler beneath, tip pure white; hind feet dark hair-brown, fore feet, fore and hind toes white; ears fuscous; sides of nose, upper lips and underparts white.

Skull short and relatively broad, with short rostrum and very short nasals; braincase relatively swollen; zygomata slender, constricted anteriorly; premaxillæ reaching just beyond nasals posteriorly; palatal foramina short, ending posteriorly on a plane with the first molars.

MEASUREMENTS OF TYPE.—Taken in the flesh: total length, 178 mm.; length of tail vertebræ, 104 mm.; length of hind foot, 18 mm.; ear, 13 mm. Skull: greatest length, 22.3 mm.; basal length, 18.3 mm.; zygomatic breadth, 12 mm.; interorbital constriction, 3.5 mm.; nasals, 6.8 mm.; width of braincase, 11.2 mm.; aveolar length upper molar series, 3.4 mm.

This subspecies is clearly in the *mexicanus* group and in some respects approaches specimens of *R. pacificus* from Finca el Cipres, but differs, however, in having longer tail, with tip white, longer fur, and larger skull

[1]The names of colors are from Ridgeway's 'Color Standards and Nomenclature.'

with more swollen braincase. In addition to the type, there is one paratype, a sub-adult male which is a shade paler than the type. Chichicastenango, marked on some maps as Santo Tomas, is in the District of El Quiché, about fifteen miles south of the city of that name. Most of the land near the town is planted with corn, but on the hills to the west the forest furnishes plenty of cover. I have named this subspecies after Mr. A. H. Howell, in honor of his extensive work on the American harvest mice.

Reithrodontomys pacificus, new species

TYPE.—No. 79331, Amer. Mus. Nat. Hist.; female, adult; Hacienda, California, six miles from Ocos, Guatemala; sea-level; November 12, 1927; collector, A. W. Anthony. The type is a skin and skull in good condition.

GENERAL CHARACTERS.—Size rather small with relatively small ears. Pelage close and short, tail concolor, about equal in length to head and body or a little longer. General coloration uniform cinnamon buff.

DESCRIPTION.—Upper parts nearly uniform dull pinkish cinnamon, sparsely darkened on dorsal surface with blackish-brown hairs; color brightest on sides; ears clove-brown; tail unicolor, clove-brown; upper surface of both fore and hind feet hair-brown; toes soiled white; sides of nose, upper lips, and underparts white.

Skull relatively small, short and broad; rostrum short; braincase rather flat, squarish and depressed posteriorly; palatal foramina short, ending posteriorly well in front of plane of first molars; audital bullæ small, ascending branches of premaxilla extending posteriorly beyond nasals; subsidiary enamel folds rather low.

MEASUREMENTS OF TYPE.—Taken in the flesh: total length, 180 mm.; length of tail vertebræ, 92 mm.; length of hind foot, 18 mm.; ear, 15 mm. Skull: greatest length, 21.2 mm.; basal length, 17.5 mm.; zygomatic breadth, 11.2 mm.; interorbital constriction, 3.5 mm.; nasals, 7.1 mm.; breadth of braincase, 10.5 mm.; aveolar length upper series, 2. 9 mm.

This species apparently belongs to the *mexicanus* group but is not closely allied to any of its geographical neighbors. It is nearest to *R. mexicanus howelli* but differs in having a shorter tail, shorter pelage and smaller skull with less swollen braincase. Besides the type there are one paratype and nine specimens from Finca Cipres referable to this species. Although the Finca Cipres specimens are somewhat different and show some individual coloration, ranging from cinnamon to cinnamon-buff, they are evidently referable to this species.

Hacienda California is a cattle ranch on the Pacific coast, six miles from Ocos, about the same distance from the Chiapas border and has the usual tropical flora. It is so near the Pacific coast that the surf can be heard. Finca Cipres is 2000 feet elevation, on the Pacific slope, at the base of the Volcan Zunil.

Reithrodontomys gracilis anthonyi, new subspecies

TYPE.—No. 79093, Amer. Mus. Nat. Hist.; female, adult; Sacapulus, Central Guatemala, 4500 feet elevation; March 2, 1928; collector, A. W. Anthony. The type is a skin and skull in good condition.

GENERAL CHARACTERS.—Size small for the genus. Color pale, similar in general characters to typical *R. g. gracilis* but paler.

DESCRIPTION.—Color of upperparts nearly uniform light pinkish cinnamon, being only a shade darker along dorsal area; ears hair-brown, very lightly margined with white; tail fuscous, only slightly paler beneath; fore feet buffy white; hind feet and underparts white.

Skull similar to that of *R. g. gracilis* but larger; rostrum short and broad, braincase relatively narrow and moderately flat; nasals short; zygomata nearly parallel to axis; palatal foramina very short; upper molar series with subsidiary enamel folds rather faintly indicated.

MEASUREMENTS OF TYPE.—Taken in the flesh: total length, 189 mm.; length of tail vertebræ, 112 mm.; length of hind foot, 20 mm.; ear, 16 mm. Skull: greatest length, 22 mm.; basal length, 18 mm.; zygomatic breadth, 11.5 mm.; interorbital constriction, 3.5 mm.; nasals, 7.5 mm.; width of braincase, 10.9 mm.; aveolar length upper molar series, 3.3 mm.

Reithrodontomys gracilis anthonyi is closely related to typical *R. gracilis gracilis* but its paler color and larger size are distinctive. In cranial characters it agrees with the latter in having a short and broad rostrum, short incisive foramina and zygomata nearly parallel to axis of skull; but the skull is much larger.

In addition to the type, there are two paratypes, a semi-adult female and an adult male which is a shade darker than the type. Sacapulus is near the headwaters of the Rio Negro, 25 miles north of Quiché. According to Mr. Anthony's MS.: "This station presents an interesting contrast to most of the surrounding fields. Located in the valley of the Rio Negro, it is a dry, sandy area, surrounded by mountains that receive many times its rainfall. The flora is similar to that of the dry sections of the Rio Motagua, with its fauna differing in a like manner." I have named this species in honor of Mr. A. W. Anthony, who collected the series.

Peromyscus guatemalensis tropicalis, new subspecies

TYPE.—No. 79233, Amer. Mus. Nat. Hist.; female, adult; Chimoxan, Guatemala, 1500 feet elevation; October 8, 1928; collector, A. W. Anthony. The type is a skin and skull in good condition.

GENERAL CHARACTERS.—Size rather large, color dark. Tail about equal to or longer than head and body, scantily haired and unevenly bicolor. Very similar to typical *R. guatemalensis guatemalensis* but somewhat smaller with shorter ears and closer pelage.

Description.—Fur moderately long, soft and full. Color of upperparts (unworn pelage), chiefly pinkish cinnamon heavily mixed with dusky, the latter concentrated on middle of back from shoulders to base of tail, forming an ill-defined broad dorsal stripe; general effect on sides cinnamon-brown becoming Prout's brown and nearly black toward middle of back; cheeks, sides of shoulders, and lateral line pinkish cinnamon-buff; a broad dark stripe extends from base of whiskers to and around eye and nearly to base of ear; tuft of fur at antarior base of ear nearly black; ear brownish black; underparts buffy white modified by plumbeous basal color; pectoral region broadly overlaid with pinkish cinnamon; fore and hind feet white; tarsal joint dusky brownish; tail unevenly bicolor, dusky above, irregularly blotched with white below.

Skull similar in general to that of *P. g. guatemalensis* but relatively smaller; nasals elongate, frontals constricted; supraorbital ridges weakly developed; braincase rather large and full but not as broad as in *P. g. guatemalensis* and with smaller molars and shorter molar toothrows than the latter.

Measurements of Type.—Taken in the flesh : total length, 265 mm.; length of tail vertebræ, 131 mm.; length of hind foot, 31 mm.; ear, 16 mm. Skull greatest length, 34.5 mm.; basilar length, 25.3 mm.; zygomatic breadth, 15.9 mm.; interorbital constriction 5.2 mm.; nasals, 13.8 mm.; aveolar length upper molar series, 4.9 mm.

Besides the type, there are twenty-two paratypes showing very little individual variation in the adult pelage. Immature specimens are much darker, almost sooty black on upperparts. *Peromyscus guatemalensis tropicalis* is apparently closely related to typical *P. g. guatemalensis,* but its smaller ears, relatively shorter tail, richer color and somewhat shorter pelage are sufficient to distinguish it from that subspecies. The type locality Chimoxan is about 40 miles northeast of Coban, the "forest typical of the coast tropics" (Anthony MS.).

Peromyscus grandis, new species

Type.—No. 79341, Amer. Mus. Nat. Hist., female, adult; Finca Concepcion, Guatemala; 3750 feet elevation, June 16, 1928; collector, A. W. Anthony. The type is a skin and skull in good condition.

General Characters.—*Peromyscus grandis* is one of the largest forms of this genus and is exceeded only in the subgenus *Megadontomys;* about equal in size to *P. zarhynchus* but possessing darker and richer pelage, shorter molar toothrow and other cranial differences.

Description.—Pelage rather long, soft and full. Color of upperparts (worn pelage), rich hazel mixed with black, the hazel everywhere predominating. Middle of back from crown of head to base of tail darker than sides; cheeks, shoulders, and flanks extensively hazel, reaching well up over sides of body. Nose and region about base of whiskers blackish; orbital and antorbital region dark blackish brown not very sharply contrasted; underparts dull white, strongly overlaid with pinkish cinnamon, especially in the pectoral region; fore and hind feet creamy white; tarsal joint brown-

ish; tail unevenly bicolor, dusky above and irregularly blotched with white below; unworn pelage slightly darker than worn pelage and with dark dorsal area more contrasted.

Skull very large, similar to that of *P. zarhynchus*, but general form more massive; rostrum and nasals broader; incisors heavier and molar toothrows shorter.

MEASUREMENTS OF TYPE.—Taken in the flesh: total length, 315 mm.; length of tail vertebræ, 150 mm.; length of hind foot, 32 mm.; ear, 22 mm. Skull: greatest length, 39 mm.; basilar length, 30 mm.; zygomatic breadth, 17.5 mm.; interorbital constriction, 5.5 mm.; length of nasals, 16.9 mm.; aveolar length of upper molar series, 5 mm.

Peromyscus grandis requires comparison only with *P. zarhynchus*. It is probably not more than subspecifically different from the latter species, but as so little is known of *P. zarhynchus* I am, on Major Goldman's suggestion, treating it as a distinct species. It compares with *P. zarhynchus* as follows: general size, similar; color very similar, but cheeks, shoulders, and flanks somewhat darker and extensively hazel instead of cinnamon rufous; lateral color extending well up over sides of body which in *P. zarhynchus* is more restricted to lower part of sides; underparts and pectoral region overlaid with pinkish cinnamon instead of cinnamon-buff as in *P. zarhynchus*; hind feet whiter. Besides the type there are two adult paratypes, both females, showing very little individual variation. Finca Concepcion is a coffee plantation thirty-five miles east of Coban. The native growth having been cleared, coffee is the principal cover.

AMERICAN MUSEUM NOVITATES

Number 561 | Published by The American Museum of Natural History New York City | Sept. 16, 1932

59.7, 55 H (69.5)

A NEW "TWO-WINGED" FLYING-FISH FROM MAURITIUS

By J. T. Nichols and C. M. Breder, Jr.

Among a number of small flying-fishes sent to us for examination, by the Museum of Comparative Zoölogy, Cambridge, Mass., we find two representing the genus *Halocypselus* (*Exocœtus* of various recent authors) from Mauritius, M.C.Z. No. 6216, labelled *Exocœtus monocirrhus*.

We have earlier recognized two species of this genus as *H. evolans* (Linnæus) and *H. obtusirostris* (Günther). Comparing the Mauritius fishes with material of comparable sizes we are convinced that they represent a third form close to *obtusirostris*, with notably longer ventral fins.

E. monocirrhus Richardson from China seems to be the same as *H. obtusirostris* (Günther), which we have examined from the eastern Pacific, and would replace it by priority. It may be as well to defer this change until Chinese material is available for comparison. Meanwhile, as there is no reason to suppose that the Mauritius form, to hand, occurs in China, we prefer to describe it as new rather than to identify it with *monocirrhus*.

Halocypselus borodini, new species

Description of Type.—No. 6216, Museum of Comparative Zoölogy, from Mauritius.

Length to base of caudal, 36 mm. Depth in this length, 3.8; head, 4.3; pectoral, 1.1. Eye in head, 2.7; snout, 3.5; interorbital (between front of eyes), 3.4; the same between middle of eyes, 2.5; maxillary, 4; barbel, 1.5; width of body, 1.6; depth of peduncle, 3; ventral, 0.9; longest dorsal ray, 1.5; longest anal ray, 1.5; lower caudal lobe (broken, est.), 0.7.

Dorsal rays, 13; anal, 12; scales (in bad condition, est.), 32.

Snout short, rounded downward. Pectoral reaching to halfway between caudal base and notch; ventrals reaching anal origin; their insertion halfway between snout and anal axil; anal origin almost exactly under that of dorsal.

Color much faded. Ventrals mostly blackish; other fins colorless. Barbel pale with a dark tip.

The one paratype (No. 9698 Amer. Mus. Nat. Hist.) is 32 mm. in length to base of caudal. Depth in this length, 3.8; head, 4.2; pectoral, 1.2; eye in head, 2.4; ventral, 0.8.

Pectoral reaching base of caudal; ventrals not quite to anal origin; their insertion halfway between end of snout and last third of anal base; anal origin almost exactly under that of dorsal.

Color is badly faded like that of the type, but in addition to the blackish ventrals it retains indications of pattern on the pectoral. The base of this fin is dark behind a line running obliquely across backward and outward from near the base of the first ray, and the tip of the fin is also dark.

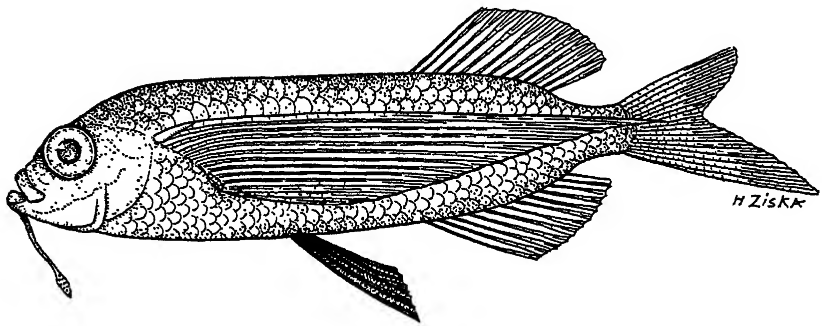


Fig. 1. *Halocypselus borodoni*, new species. Type.

The present species, closest to *H. obtusirostris*, is distinctly different from it and more so from *H. evolans*, in the possession of longer pectoral and ventral fins and a shorter head. In the specimens examined the pectorals are 1.1 or 1.2 in the length, as against 1.4, or shorter, in small specimens of the other species; the ventrals are longer than head, as against shorter. Other slight variations are not considered significant. The smaller specimen has the ventral insertion notably more anterior than that of the type. In this material little can be concluded as to its possible shift in position with size, but various progressive changes have been shown in this proportion in the other two species by Nichols and Breder, 1928, and Breder, 1928.[1]

We take pleasure in naming this fish for Dr. N. A. Borodin, who has called it to our attention and who must have spent recently many tedious hours making valuable ichthyological collections in the Museum of Comparative Zoölogy more available for study.

[1]Nichols, J. T., and Breder, C. M., Jr., 1928, 'An Annotated List of the Synentognathi, with Remarks on Their Development and Relationships.' Zoölogica, VIII, No. 7, June 11, p. 432.
Breder, C. M. Jr., 1928, 'Nematognathi, Apodes, Isospondyli, Synentognathi and Thoracostraci from Panama to Lower California with a Generic Analysis of the Exocœtidæ.' Bull. Bingham Oceanographic Collection, II, Art. 2.

AMERICAN MUSEUM NOVITATES

Number 562 | Published by The American Museum of Natural History New York City | Sept. 17, 1932

59 9,32 C (801)

THE TAXONOMIC HISTORY OF THE NEOTROPICAL CRICETID GENERA *HOLOCHILUS, NECTOMYS, SCAPTEROMYS, MEGALOMYS, TYLOMYS* AND *OTOTYLOMYS*

By G. H. H. Tate

This review, the third of a series of historical papers on the rats of South and Central America, deals with those genera which contain the larger rat-like species. Although not very closely related, they are conveniently handled in a single article.

HISTORICAL STATEMENT

Holochilus Brandt

1819. Desmarest described (p. 62) *Mus brasiliensis* (n. sp.), collected by Auguste F. C. P. de Saint-Hilaire, a botanist who traveled over most of Brazil. The credit given Geoffroy was probably for the unpublished name *brasiliensis*.

1820. Desmarest (p. 305) opined that his *brasiliensis* was the same as *angouya* (an *Oryzomys*) and treated it as a synonym. But he had probably never seen a specimen of *angouya*, which he had previously based upon the RAT TROISIÈME of Azara.

1827. Brants described (p. 137) *Mus vulpinus* (n. sp.) and (p. 139) *Mus physodes* (n. sp.), giving credit for both names to Lichtenstein.

1830. Lichtenstein further described (Pl. XXXIII) *Mus vulpinus* and (Pl. XXXIV) *Mus physodes*. [In 'Einleitung zum siebenten Heft,' Lichtenstein clearly gave Brants credit for prior publication. This work bears only the inclusive dates 1827–1834, but Trouessart gives 1830 for *Scapteromys tomentosus* Lichtenstein.]

1835. Brandt erected (p. 428) *Holochilus* new subgenus of *Mus*, including in it *Mus* (*Holochilus*) *leucogaster* (n. sp.) which was synonymized by Trouessart, 1898, with *physodes*, and (p. 430) *Mus* (*Holochilus*) *anguya* (n. sp.).

1839. Waterhouse described (p. 58) a rat which he identified as *Mus brasiliensis* from Bahia Blanca, thinking it equal to *brasiliensis* Desmarest. He stated that he had examined what he believed to be the original specimen of *brasiliensis* in Paris, and took care to point out that *angouya* Desmarest (an *Oryzomys*), confused by some authors with *brasiliensis*, was quite a different animal. He thought the description of *anguya* Brandt more like *brasiliensis*. With the erection (p. 75) of his *Hesperomys*, *brasiliensis* became included therein.

1841. Lund wrote (p. 279) of "*vulpinus*," giving measurements and description of color. His animal was apparently an *Oryzomys*.

1842. Wagner re-diagnosed (p. 14) *Holochilus* in detail, treating it as a full genus, and discussed the species which ought to be included in it. He described *Holochilus sciureus* (n. sp.). He was later convinced (p. 288) that the "*brasiliensis*" of Waterhouse belonged in *Holochilus*.

1843. Wagner placed (p. 536) *physodes* with *auritus* (a *Reithrodon*) and *orobinus*, *subflavus* and *angouya* (none of them *Holochilus*) in a subgeneric group of *Hesperomys* which he gave no name but described as having "tarsi mediocres, auriculae majusculae nec non cauda elongata nudiuscula." In a footnote (p. 544) he wrote that *vulpinus* Lichtenstein and *vulpinus* Lund were distinct from each other. He treated (p. 548) *Holochilus* as a full genus, listing in it *brasiliensis*, *leucogaster* (Wagner), *canellinus*, *sciureus*, and *vulpinus*. He remarked in numerous footnotes upon the relationships of these species.

1844. Pictet and Pictet wrote of (p. 53) *Mus brasiliensis* Geoffroy. They thought (p. 80) that *leucogaster* Brandt might in reality be a rat imported from the Old World.

1845. Wagner described (p. 147) "*Hesperomys leucogaster*," which from its color and rather large size may be referable to *Holochilus*. Judging by the proportions of the measurements given in each case, *leucogaster* Wagner is quite distinct from *leucogaster* Brandt.

1847. Gay described (p. 108) and figured (Pls. VI and VII) *Mus lutescens* (n. sp.), in reality one of the Old World rats (see Wolffsohn, 1910).

1850. Wagner added information (p. 306) about his *leucogaster* and described *Hesperomys russatus* (n. sp.).

1854. Burmeister in the 'Systematische Uebersicht' made *Holochilus* (including *Nectomys*) and *Calomys* subgenera of *Hesperomys*. Under the former he described *robustus*, n. sp. (a *Nectomys*), and included *vulpinus* (Lichtenstein), *squamipes*, and *physodes*. He placed *brasiliensis* of Waterhouse in the synonymy of *vulpinus, sciureus* under *squamipes*, and *russatus* under *physodes*.

Leucogaster (Wagner) was put in *Calomys*, and *leucogaster* (Brandt) was compared (p. 171) with *physodes*.

1855. Burmeister (1854, p. 5) treated *Holochilus*, plus *Nectomys*, as a sub-group of *Hesperomys* and remarked upon *robustus* (a *Nectomys*), stating that *robustus* was the rat which the Pictets (1844) referred to *brasiliensis* and probably the *aquaticus* of Lund. He also discussed *vulpinus*, to which he referred the *brasiliensis* of Waterhouse; *squamipes*, under which he placed *sciureus* Wagner, *anguya* Brandt and *canellinus* Wagner; and *physodes*, with which he synonymized *russatus* Wagner.

1866. Lilljeborg made (p. 17) *Holochilus* (including *Nectomys*) a full genus.

1867. Fitzinger listed (p. 89) under *Holochilus: brasiliensis, robustus* (a *Nectomys*), *leucogaster, russatus, physodes, squamipes* (a *Nectomys*), *canellinus, sciureus, vulpinus*, and *arviculoides* (a *Zygodontomys*).

1872. Hensel dispensed with (p. 32) all subgeneric names, listing instead all South American Cricetids under *Hesperomys* (*sensu lato*). The only *Holochilus* dealt with was *vulpinus*, which he distinguished from other rats by the vague character: "cheek-teeth without cusps, lacking enamel."

1876. Alston treated (p. 84) *Holochilus* as a full genus, but seemingly included *Nectomys* in it.

1879. Burmeister listed (p. 210) *vulpinus* under *Hesperomys* (*Holochilus*).

1882. Thomas recorded (p. 101) specimens of *apicalis* (*Nectomys*) under "*Holochilus* (*Nectomys*)."

1883. Pelzeln commented (p. 67) upon *leucogaster* (Wagner) obtained by Natterer. He listed (p. 71) *russatus, physodes,* and (p. 73) *brasiliensis.*

1884. Thomas treated (p. 448) *Holochilus* (including *Nectomys,* p. 451) as a full genus.

1885. Trouessart, in course of discussing the status of *Megalomys,* reviewed (pp. 1–18) the inter-relationships of *Holochilus* and *Hesperomys.*

1887. Winge placed (p. 21) *vulpinus* under *Sigmodon.* (Thomas, 1897, p. 495, stated that Winge's animal was *sciureus.*)

1894. Ihering listed *brasiliensis, physodes, leucogaster,* and *sciureus,* but his synonymy and identifications appear to be open to question.

1896. Thomas listed (p. 1020) *Holochilus* as a full genus, including in it *Nectomys.*

1897*b*. Thomas described (p. 495) *Holochilus nanus,* n. sp., comparing it with *sciureus.* He added that *Nectomys* and *Holochilus* were really distinct genera. He proposed *darwini,* new name for the *brasiliensis* of Waterhouse. One or both of the names *vulpinus* and *canellinus* were thought applicable to the species of the Parana and Uruguay River systems. *Brasiliensis* Geoffroy (Desm. 1819) and *leucogaster* Brandt (1835) could not then be identified.

1898. Trouessart moved *Megalomys* into *Holochilus* as a separate subgenus. He listed in true *Holochilus: brasiliensis* Desmarest, *vulpinus, darwini, sciureus, canellinus, nanus, physodes, russatus,* and *lutescens.*

Anguya Brandt, though of earlier date, was suppressed in favor of *canellinus* Wagner. This was probably done on account of an idea that *Mus* (*Holochilus*) *anguya* Brandt was pre-occupied by *Mus angouya* Desmarest. However, since the rule defining homonyms ('Int. Rules Nomencl.,' 1926, Art. 35) does not apply to *ou* and *u, Mus angouya* Desmarest cannot now be considered as preoccupying *Mus anguya* Brandt, and *Orzomys angouya* and *Holochilus anguya* are valid names connoting perfectly distinct animals. *Leucogaster* Brandt was made a synonym of *physodes,* another irregularity; *leucogaster* Wagner was omitted, and *leucogaster* Pictet was made a synonym of *Mus* (*Epimys*)

rattus. *Vulpinus* Lund (1841) was placed (p. 421) in the synonymy of *subflavus* Wagner.

1900. Phillippi described (p. 29) *Mus simpsoni* (n. sp.), which he characterized as the largest rat in Chile, but which may possibly only be a form of *Rattus*. He compared it with *darwini* ("*brasiliensis* Geoffroy") and *lutescens*. He also described *Mus agilis* (n. sp.), comparing it with *lutescens*. I do not consider *agilis* a *Holochilus;* but Trouessart lists it (1905, p. 412) with a query.

1901*a*. Thomas described (p. 149) *Holochilus guianæ*, n. sp.

1902. Miller and Rehn (p. 89) designated the type of *Holochilus* as *leucogaster* Brandt.

1904. J. A. Allen described (p. 330) *Holochilus venezuelæ*, n. sp.

1905. Trouessart listed in *Holochilus* (p. 411): *brasiliensis*, *vulpinus*, *darwini*, *sciureus*, *guianæ*, *canellinus*, *nanus*, *physodes*, *physodes leucogaster*, *russatus*, *lutescens*, *simpsoni* and questionably *agilis*. The main change from his list of 1898 was the recognition of *leucogaster* (Brandt). He removed (p. 415) *Megalomys* from *Holochilus*.

1906*a*. Thomas described (p. 446) *Holochilus chacarius*, n. sp., and (p. 447) *Holochilus balnearum*, n. sp.

1910 Wolffsohn quoted (p. 96) from a letter in which Thomas stated that *Holochilus lutescens* was nothing but *Mus rattus*. "I have seen the type in Paris." (See Gay, 1847.)

1915. Osgood described (p. 188) *Holochilus amazonicus*, n. sp. He remarked upon the relationships of *amazonicus* and upon the geographical range of *Holochilus*.

1921. Thomas described (p. 226) *Holochilus incarum*, n. sp. He doubted whether *guianæ* and *amazonicus* should have been separated from *sciureus*.

1927. Thomas wrote under *sciureus* (p. 369): "I now see no sufficient reason for distinguishing the Peruvian Red Water-rat from that of the Lower Amazon."

1928. Thomas wrote (p. 260): "As time goes on and material increases, I am more and more convinced of the essential identity of all the *Holochilus* water-rats of the whole of the Amazonian drainage area, from Pernambuco to Peru, Guiana to Bolivia, and equally that of the Rio San Francisco." He considered that due to aquatic habits

the "hind-foot length" of water-rats must be used with caution. He thought with Winge that the dentition might indicate some affinity with *Sigmodon*.

Nectomys Peters

1827. Brants described (p. 138) *Mus squamipes* (n. sp.), giving Lichtenstein credit for the name.

1841. Lund wrote of (p. 279) *Mus aquaticus,* describing its swimming feet, measurements and color. The description fits *Nectomys*.

1843. Wagner placed (p. 515–516) *squamipes* with *Scapteromys tomentosus, Oxymycterus rufus* and some *Oryzomys* under a heading: *Hesperomys* (*incertæ sedis*).

1854. Burmeister (p. 164) described *Hesperomys* (*Holochilus*) *robustus* (n. sp.) and kept *squamipes* in *Hesperomys* (*Holochilus*).

1855. Burmeister wrote (1854, p. 5) on *Holochilus* plus *Nectomys,* referring *aquaticus* (Lund 1841) to his *Holochilus robustus*.

1860. Peters erected (p. 135) *Nectomys,* n. g., to contain *squamipes*. He described *Nectomys apicalis,* n. sp.

1866. Lilljeborg in his system included (p. 17) *Nectomys* in *Holochilus*.

1867. Fitzinger gave (p. 84) only *aquaticus* Lund under *Nectomys*. He listed *squamipes* in *Holochilus*.

1872. Hensel, omitting subgeneric terms, discussed (p. 34) only *Hesperomys squamipes*.

1872. Liais wrote (p. 507) concerning a form of *Nectomys* which he called *Potamys brasiliensis*.

1879. Burmeister stated (p. 212) "*Mus aquaticus* Lund is a true *Nectomys* and identical with *N. squamipes* Licht. (*H. robustus* Burm.)."

1882. Thomas placed *apicalis* under "*Holochilus* (*Nectomys*)."

1883. Pelzeln described (p. 73) *Hesperomys rattus* (n. sp.), asserted by Thomas (1897) to be *Nectomys*.

1886. Leche concluded (p. 690) that *apicalis* was a synonym of *squamipes*.

1887. Winge compared (p. 57) *squamipes* with "*Calomys laticeps*," treating *Nectomys* as a full genus.

1893. Allen and Chapman described (p. 209) *Nectomys palmipes,* n. sp.

1896. Thomas included (p. 1020) *Nectomys* in the full genus *Holochilus*.

1897*a*. Thomas stated (p. 486): "*Nectomys* should be restored to full (generic) rank at 74*a*" (in his 'Genera of Rodents,' 1896).

1897*b* Thomas discussed (p. 497) *Nectomys*, stating that *Hesperomys rattus* Pelzeln was a *Nectomys* and reviewing other existing species. He described *Nectomys grandis*, n. sp., *Nectomys magdalenæ* n. sp., and *Nectomys fulvinus*, n. sp.

1897*c*. Thomas described (p. 546) *Nectomys saturatus*, n. sp., and (p. 547) *Nectomys russulus*, n. sp.

1897. J. A. Allen erected (p. 38) *Sigmodontomys*, n. g., with type *Sigmodontomys alfari*, n. sp., based upon a single specimen.

1898. Trouessart listed (pp. 521–2) *squamipes*, *rattus*, *apicalis*, *palmipes*, *grandis*, *magdalenæ*, and *fulvinus*. *Aquaticus*, *robustus* and *brasiliensis* Pictet were placed in the synonymy of *squamipes*. He listed *Sigmodontomys* Allen separately.

1899*a* Thomas described (p. 41) *Nectomys garleppii*, n. sp.

1901*b* Thomas described (p. 250) *Nectomys esmeraldarum*, n. sp. He considered that *esmeraldarum*, *russulus* and probably *Sigmodontomys* "*alfaroi*" Allen formed a special group less adapted for aquatic life than typical *Nectomys*.

1903. Thomas described (p. 238) *Nectomys squamipes mattensis*, n. subsp.

1905. Thomas described (p. 586) *Nectomys dimidiatus*, n. sp. He stated: "Allen's *Sigmodontomys alfari* and the closely allied *Nectomys russulus* are forms with more *Oryzomys*-like fur; but their exact generic position is not at present easy to define, owing to want of specimens with unworn teeth."

1905. Trouessart listed (p. 412) *squamipes*, *rattus*, *garleppi*, *palmipes*, *grandis*, *saturatus*, *magdalenæ*, *fulvinus*, *russulus*, and *esmeraldarum*.

He again listed (p. 427) *Sigmodontomys* Allen.

1908. J. A. Allen described (p. 655) *Oryzomys ochraceus*, n. sp. (Removed later, 1916, to *Nectomys*.)

1910. Thomas described (p. 185) *Nectomys squamipes melanius*, n. subsp.

1911. Miller designated (p. 180) *squamipes* as type of *Nectomys*.

1913. Goldman described (p. 7) *Nectomys alfari efficax*, n. subsp. He contrasted it with *Sigmodontomys alfari* and *Nectomys esmeraldarum* and concluded that *Sigmodontomys* should be placed under *Nectomys*.

1913. Thomas described (p. 570) *Nectomys hammondi*, n. sp. He wrote: ". . . *Nectomys* falls into two groups, firstly the . . . species related to *N. squamipes* (*N. apicalis*, *garleppi*, *fulvinus*, etc., etc.,) . . . and secondly a few isolated species . . . showing their relationship to the ordinary *Nectomys* by their glossy fur and heavily ridged skull." In these he included *russulus*, *hammondi*, *esmeraldarum*, *dimidiatus*, and *saturatus*.

1914. Hollister described (p. 104) *Nectomys squamipes pollens*, n. subsp.

1914. Osgood suggested (p. 160) that Guiana rather than Quito might well be type locality of *N. fulvinus* Thomas.

1916. Goldman transferred (p. 127) *Oryzomys ochraceus* Allen to *Nectomys* as a synonym of *Sigmodontomys* (=*Nectomys*) *alfari* Allen.

1928. Thomas wrote (p. 260): "In the genus *Nectomys* there seems to be a greater tendency for the development of local races than is the case with *Holochilus*." He thought that *Nectomys* showed some relationship with *Rhipidomys*.

SCAPTEROMYS Waterhouse

1830. Lichtenstein described (Pl. XXXIII) *Mus tomentosus* (n. sp.).

1837. Waterhouse described *Mus tumidus* (n. sp.) and erected (p. 20) *Scapteromys* new subgenus of *Mus* to contain *tumidus*, making *tumidus* the type of the genus by monotypy.

1839. Waterhouse further described (p. 57) *tumidus*. When he proposed (p. 75) his blanket-genus *Hesperomys*, he ignored his own name *Scapteromys* but included *tumidus*.

1841. Lund spoke of (p. 276) *Mus principalis* and *fossorius*: ". . . . two recent species which, however, I only find as skeletons in caves. One I call *Mus principalis*, since it exceeds all other species in size; the other *Mus fossorius*, because it shows such strong development of the crests of the humerus that it must have ability to burrow in the ground highly developed."

1841. Wagner, who apparently had not yet heard of Waterhouse's new genus *Hesperomys*, suggested (p. 125) in a footnote that *Scapteromys* probably belonged in *Reithrodon*.

1843. Wagner discussed (pp. 515–516) *tumidus* under *Hesperomys* (*Scapteromys*). *Tomentosus*, with *squamipes* (a *Nectomys*), *rufus* (an *Oxymycterus*), and several *Oryzomys*, was located in a group under the caption "*incertæ sedis.*"

1859. Baird combined (p. 453) *Scapteromys* with "*Oxymicterus*" to make a single genus *Oxymicterus*.

1860. Peters remarked (p. 135) that *Mus tomentosus* constituted a second species of the subgenus *Scapteromys*.

1867. Fitzinger, in addition to *tumidus*, placed (p. 80) *dasytrichos* Wied (an *Oxymycterus*) in *Scapteromys* (made a full genus); but he put *tomentosus* in *Habrothrix*.

1872. Hensel, omitting subgeneric names, discussed (p. 46) *Hesperomys tumidus*.

1884. Thomas considered (p. 449) *Scapteromys* a subgenus of *Hesperomys* (*sensu lato*).

1887. Winge described (p. 39) *Scapteromys labiosus*, n. sp., treating *Scapteromys* as a full genus. He gave (p. 42) a detailed description of *principalis* Lund as well as that of a fossil form, *fronto*, n. sp.

1896. Thomas listed (p. 1020) *Scapteromys* as a full genus.

1898. Trouessart listed (p. 534) in *Scapteromys: tumidus, tomentosus, labiosus*, and *principalis*.

1905. Trouessart made (p. 431) no changes in his list of 1898.

1914. Ribeiro described (p. 37) *Scapteromys gnambiquaræ*, n. sp., doubtfully distinct from *principalis* Lund and (p. 39) *Scapteromys modestus*, n. sp., "resembling *Scapteromys labiosus* Lund." (Winge, not Lund, described *labiosus*.) No type locality was given nor was any type specimen named for either species.

1917. Thomas stated (p. 96) that he thought *Scapteromys tomentosus* merely a black form of the grayer *tumidus*.

1920. Thomas discussed (p. 477) the *Scapteromys* of the Parana Delta. He modified his remarks of 1917 and cited Matschie as having informed him that *tomentosus*, which he now thought quite distinct, was from near Maldonado. He proposed *Scapteromys aquaticus*, n. sp., for the delta form.

1929. Sanborn (p. 158) quoting Thomas (1920) suggested that *tumidus* and *tomentosus* may in time prove to be synonyms. But in the same article the latter said "In size *tomentosus* would appear to exceed considerably both *tumidus* and the delta form, as its hind foot, including claws, is said to be 2 inches in length." At that time, therefore, Thomas regarded them as distinct species.

1932. Gyldenstolpe described *Scapteromys chacoensis*, n. sp. He compared it with the fossil form *fronto* Winge and mentioned that a cotype of *gnambiquaræ* Ribeiro was now in the British Museum.

MEGALOMYS Trouessart

1658. DeRochefort wrote (p. 124) of "Les rats musqués, que nos francais appellent Piloris."

1667. Père du Tertre remarked upon these animals. [I have not seen his account.]

1763. Buffon spoke (p. 3) of the "piloris."

1771. Pennant wrote (p. 247) of *Cavia moschata.*

1777. Zimmermann discussed (p. 509) *Castor piloris.*

1778. Pallas wrote (p. 91) under *Mus* (*Pilorides*) a composite description based partly upon a rodent from Ceylon and partly upon the West Indian piloris.

1827. Desmarest employed (p. 483) *Mus pilorides* to describe a rat "peu plus petite que le surmulot" and considered it altogether distinct from the piloris of de Rochefort.

1829. Fischer described (p. 360) *M*[*us*] *desmarestii* (n. sp.). He had previously characterized *M. pilorides* Pallas.

1830. Geoffroy St. Hilaire and Cuvier published a very important colored figure, accompanied by a less important description of the "pilori."

1843. Wagner (p. 444) listed "*Mus Pilorides* Pallas" in an appendix under *Mus.*

1881. Trouessart stated (p. 356) that after examining the mounted and alcoholic specimens in the Paris Museum, sent many years before by M. Plée from Martinique, he had no doubt that they were members of the genus *Hesperomys* (*sensu lato*) and erected *Megalomys*, n. subg., with type "*Mus pilorides* (Desmarest)," placing

it near *Nectomys*. Additional specific characters and measurements were given.

1884. Thomas said (p. 450): "*Megalomys* Trouess. founded on *H. pilorides*, Pall., seems to me to fall within the genus *Holochilus*, Bdt., and not to be a true *Hesperomys* at all."

1885. Trouessart took exception (Article 5) to *Thomas's* (1884) statement. He listed in detail the five specimens in the Paris Museum, published a plate showing the skull (dorsal and lateral views), teeth, and feet of *Megalomys*, compared the anatomy in detail with that of other South American genera, and concluded by giving (p. 13) a new diagnosis of the subgenus.

1898. Trouessart listed (p. 520) *Megalomys* as a subgenus of *Holochilus*. The only species given was *pilorides* Pallas.

1901. Major stated (p. 205) that one of the cotypes "from Martinique, presented by Plée to the Paris Museum, has found its way to the Leyden Museum, and its skull was kindly lent to me by Dr. Jentinck." He had also before him B.M. 53.12.16.4 from Santa Lucia and a fossil species which he did not describe. He concluded from this material that the rats in question belonged in the genus *Oryzomys*, and after listing the synonymy of "*Oryzomys piloris* (Zimmerm.)" described *Oryzomys luciæ*, n. sp., with the specimen mentioned above as type.

1902. Miller and Rehn placed (p. 89) *pilorides* in *Holochilus*, full genus.

1902. J. A. Allen, discussing the Piloris, said (pp. 20–21): "If the name *Mus pilorides* given to this animal by Desmarest in 1826 is preoccupied by *Mus pilorides* Pallas, 1786, as seems to be the case, the proper name of the Rat musqué, or Piloris, will be *Mus desmaresti* of Fischer, 1829, =*Megalomys desmaresti* (Fischer), or *Oryzomys desmaresti* (Fischer) for those who believe, with Mr. Forsyth Major, that *Megalomys* is not separable from *Oryzomys*."

1903. Trouessart retracted his belief that *Megalomys* and *Holochilus* were closely allied. He opposed entirely Major's view that *Megalomys* was related to *Oryzomys*, and, considering his own name *Megalomys* preoccupied by *Megamys* Laurillard, substituted *Moschomys*, new name.

He stated that *pilorides*, being a composite name based upon two distinct species, ought to be dropped; that *piloris* and *moschata* were unavailable; but that *desmaresti* Fischer might be employed. In conclusion he listed three species: *Moschomys desmaresti* (Fischer), *M. luciæ* (Major), and *M.* species (Major's unnamed fossil).

1904. Poche, referring to Trouessart's discussion of *Megamys* and *Megalomys* (1903), cited the international nomenclature rules regarding preservation of the original spelling of a name, and concluded that *Megalomys* was *not* preoccupied by *Megamys*, so that *Moschomys* would have to be set aside, and *Megalomys* reinstated.

1904. Elliot, ignorant of Poche's note, found (p. 270) *Moschomys* Trouessart preoccupied by *Moschomys* Bellberg and proposed *Moschophoromys* instead.

1905. Trouessart, having several times changed his views regarding the status of this genus, now gave it (p. 415) full rank and set it well away from *Holochilus*. He proposed *majori*, n. sp.—a *nomen nudum*—for the unnamed fossil species mentioned by Major (1901), and listed also *desmaresti* and *luciæ*.

1911. G. M. Allen followed (pp. 415–16) Trouessart's arrangement (1905) and recited the known history of each species.

1911. Miller placed (p. 178) *Megalomys* next to *Tylomys*. [The plate by Geoffroy and Cuvier (1830), portraying the living animal, suggests *Tylomys* in certain respects—notably in the color pattern, but the tail is very different. I have compared the skulls of several genera, *Tylomys*, *Ototylomys*, *Holochilus*, and *Nectomys*, with the figures given by Trouessart (1885). Unfortunately, he neglected to give a palatal view, so I could not learn whether or not *Megalomys* possesses very large palatal foramina as in *Tylomys*. Its teeth (separately drawn) are very different from those of *Tylomys*, and I can only conclude that it represents a thoroughly distinct genus.]

1926. Hopwood described (p. 328) and figured (Pl. XII, figs. 1–2) *Megalomys audreyi*, n. sp. This represented the hitherto undescribed fossil of Major (1901) and *majori* (*nomen nudum*) Trouessart. From the wording (p. 330), *luciæ* would appear to be truly a *Megalomys* and not an *Oryzomys*.

Tylomys Peters

1866. Peters erected (pp. 404–409) *Hesperomys* (*Tylomys*), n. subg., to contain *nudicaudatus*, n. sp. He figured the skull with great care.

1873. Gray erected (p. 417) *Neomys*, n. g., to contain *Neomys panamensis*, n. sp., whose skull he figured.

1880. Alston placed (p. 150) *Neomys* Gray in the synonymy of *Tylomys*.

1890. J. A. Allen further described (p. 210) *nudicaudatus* (from Costa Rica).

1893. Allen and Chapman described (p. 211) *Tylomys couesi*, n. sp. (See Allen and Chapman, 1897.)

1897. Allen and Chapman removed (p. 29) *couesi* (1893) from *Tylomys* to *Rhipidomys*.

1898. Trouessart listed (p. 520) *nudicaudatus*, *couesi*, *panamensis* and "*carri*." The last was an error (p. 1324), *carri* referring not to *Tylomys* but to *Thylamys*, a murine opossum.

1899. Thomas described (p. 278) *Tylomys miræ*, n. sp., and *Tylomys watsoni*, n. sp.

1901. Merriam described (p. 560) *Tylomys tumbalensis*, n. sp., and (p. 561) *Tylomys bullaris*, n. sp.

1902. Miller and Rehn designated (p. 88) *nudicaudatus* type of *Tylomys*.

1905. Trouessart listed (p. 411) *miræ*, *nudicaudatus*, *panamensis*, *tumbalensis*, *bullaris*, and *watsoni*.

1916. Anthony described (p. 366) *Tylomys fulviventer*, n. sp.

1920. Goldman remarked upon (p. 90) *panamensis*, *watsoni*, and *fulviventer*.

Ototylomys Merriam

1901. Merriam erected (p. 561) *Ototylomys*, n. g., to contain *Ototylomys phyllotis*, n. sp., and *Ototylomys phyllotis phæus*, n. subsp. He contrasted the new genus with *Tylomys*, and also with *Xenomys*, *Peromyscus*, and *Neotoma*.

1905. Trouessart listed (p. 410) *phyllotis* and *phyllotis phæus*.

1908. J. A. Allen described (p. 658) *Ototylomys fumeus*, n. sp.

1909. Thomas described (p. 669) *Ototylomys guatemalæ*, n. sp.

1931. Osgood described (p. 145) *Ototylomys phyllotis australis*, n. subsp. He suggested that *phyllotis*, *fumeus*, and *guatemalæ* differ in characters of only subspecific importance.

PRESENT STATUS OF THE GENERA

Genus *Holochilus* Brandt	Type by subsequent designation (Miller and Rehn, 1902): *Mus (Holochilus) leucogaster* Brandt
Genus *Nectomys* Peters	Type by subsequent designation (Miller, 1911): *Nectomys squamipes* Brants
Genus *Scapteromys* Waterhouse	Type by monotypy: *Scapteromys tumidus* Waterhouse
Genus *Megalomys* Trouessart	Type by subsequent designation (Allen, 1902): *Megalomys desmarestii* (Fischer)
Genus *Tylomys* Peters	Type by monotypy: *Tylomys longicaudatus* Peters
Genus *Ototylomys* Merriam	Type by monotypy: *Ototylomys phyllotis* Merriam

List of Specific and Subspecific Names[1] with Type Localities

Holochilus	
brasiliensis (Desmarest)	Brazil
vulpinus (Brants)	Brazil (Brants); Uruguay, coll. by Sello (Lichtenstein)
physodes (Brants)	São Paulo, Brazil
leucogaster (Brandt)	Brazil
anguya (Brandt)	Brazil
sciureus Wagner	Rio San Francisco, Brazil
leucogaster (Wagner) (preoccupied)	Woods of Ypanema, São Paulo, Brazil
russatus (Wagner)	Ypanema, São Paulo, Brazil
nanus Thomas	Marajó Island, lower Amazon, Brazil
darwini Thomas	Bahia Blanca, Argentina
simpsoni (Philippi)	Santo Domingo Island, W. Patagonia
guianae Thomas	Kanuku Mts., British Guiana
venezuelæ Allen	El Llagual, Venezuela
chacarius Thomas	Chaco, one league NW. of Concepcion, Paraguay
balnearum Thomas	Bañado de San Felipe, Tucuman, Argentina
amazonicus Osgood	Itacoatiara, R. Amazon, Brazil
incarum Thomas	Santa Ana, near Cuzco, Peru
Nectomys Peters	
squamipes squamipes (Brants)	Brazil
squamipes mattensis Thomas	Santa Ana de Chapada, Sierra de Chapada, 30 miles NE. of Cuyaba, Matto Grosso, Brazil
squamipes pollens Hollister	Sapucay, Paraguay
squamipes melanius Thomas	Lower Essequibo R., 12 miles from mouth, British Guiana

[1]Since no works of a revisional nature have been published on these genera, it has been thought advisable to list all specific and subspecific names, even though some already have been and others unquestionably will be placed in synonymy.

aquaticus (Lund)	Lagoa Santa, Brazil
robustus (Burmeister)	Northeastern Brazil
apicalis Peters	Guayaquil, Ecuador
rattus (Pelzeln)	Marabitanas, Rio Negro, Brazil
palmipes Allen and Chapman	Princestown, Trinidad
grandis Thomas	Concordia, Medellin, Colombia
magdalenae Thomas	Near Rio Magdalena, West Cundinamarca, Colombia
fulvinus Thomas	"Believed to be Quito," but may be Cayenne
saturatus Thomas	Ibarra, northern Ecuador
russulus Thomas	Valdivia, Colombia; 1200 metres
alfari alfari (Allen)	Jimenez, Costa Rica
alfari efficax Goldman	Cana, Eastern Panama
garleppii Thomas	Ocabamba, Cuzco, Peru
esmeraldarum Thomas	St. Javier, Prov. Esmeraldas, W. Ecuador
dimidiatus Thomas	Escondido R., 3 miles below Rama, Nicaragua
ochraceus (Allen)	Rio Grande, south of Tuma, Nicaragua
hammondi Thomas	Mindo, NW. of Quito, Ecuador
Scapteromys Waterhouse	
tomentosus (Lichtenstein)	Wooded parts of Uruguay
tumidus (Waterhouse)	Maldonado, Uruguay
principalis (Lund)	Lagoa Santa, Brazil
fossorius[1] (Lund)	Lagoa Santa, Brazil
labiosus Winge	Lagoa Santa, Brazil
gnambiquarae Ribeiro	Range: "In the campos of Chapadao, from Ultimo Acampamento northward"
modestus Ribeiro	Range: Caceres and Porto Espiridiao, Matto Grosso, Brazil
aquaticus Thomas	Isla Ella, Parana Delta
chacoensis Gyldenstolpe	Rio de Oro, Chaco Austral, Argentina
Megalomys Trouessart	
desmarestii (Fischer) (=*pilorides* Pallas)	Martinique
luciae (Major)	St. Lucia
Tylomys Peters	
nudicaudatus Peters	Guatemala
panamensis (Gray)	Panama
mirae Thomas	Paramba, Rio Mira, N. Ecuador
watsoni Thomas	Bogava, Chiriqui, NW. Panama
tumbalensis Merriam	Tumbala, Chiapas, Mexico
bullaris Merriam	Tuxtla, Chiapas, Mexico
fulviventer Anthony	Tacarcuna, Darien, Panama
Ototylomys Merriam	
phyllotis phyllotis Merriam	Tunkas, Yucatan, Mexico
phyllotis phaeus Merriam	Yohaltun, Campeche, Mexico

[1] *Fossorius*, based solely upon bones found in a cave or hole, is given no standing by Trouessart, 1898 and 1905 Its inclusion here as a living form is, of course, provisional. It may have represented fragments of *Blarinomys*.

fumeus Allen	Matagalpa, Nicaragua
guatemalæ Thomas	Tucuru, Polochie R., about 50 miles East of Coban, Guatemala

BIBLIOGRAPHY

ALLEN, G. M. 1911. Bull. Mus. Comp. Zoöl., LIV, pp. 175–263.

ALLEN, J. A. 1890. Bull. Amer. Mus. Nat. Hist., III, pp. 263–310.
1897. Bull. Amer. Mus. Nat., Hist., IX, pp. 31–44.
1902. Bull. Amer. Mus. Nat. Hist., XVI, pp. 13–22.
1904. Bull. Amer. Mus. Nat. Hist., XX, pp. pp. 327–335.
1908. Bull. Amer. Mus. Nat. Hist., XXIV, pp. 647–670.

ALLEN, J. A., AND CHAPMAN, F. M. 1893. Bull. Amer. Mus. Nat. Hist., V, pp. 203–234.
1897. Bull. Amer. Mus. Nat. Hist., IX, pp. 13–30.

ALSTON, E. R. 1876. Proc. Zool. Soc. London, pp. 82–85.
1880. 'Biologia Centrali-Americana,' Mammalia.

ANTHONY, H. E. 1916. Bull. Amer. Mus. Nat. Hist., XXXV, pp. 357–376.

BAIRD, S. F. 1859. 'Mammals of North America.'

BRANDT, J. F. 1835. Mem. Acad. St. Petersburg, (6) III, pp. 357–442.

BRANTS, A. 1827. 'Het geschlacht Muizen . . . ,' p. 137.

BUFFON, G. L. L. DE. 1763. Hist. Nat., 2nd Ed., X, p. 3.

BURMEISTER, H. 1854. 'Syst. Uebersicht der Thiere Brasiliens.'
1854. Abh. Naturf. Ges. Halle, II (1), Sitz., pp. 3–10. [Berg shows (Anales Mus. Nac. Buenos Aires, (2) I, p. 334) that the date of actual publication of this volume was 1855.]
1879. 'Descrip. Phys. Argentina,' III.

DEROCHEFORT, C. 1658. 'Hist. Nat. Morale Iles Antilles,' I, p. 124.

DESMAREST, A. G. 1819. Nouv. Dict. d'Hist. Nat., 2nd Ed., XXIX, pp. 40–71.
1820. 'Mammalogie,' II, p. 305.
1827. Dict. Sci. Nat., XLIV, p. 483.

ELLIOT, D. G. 1904. Field Mus. Nat. Hist., Zool. Ser., III, No. 15.

FISCHER, J. B. 1829. 'Geographische Gesch.,' II, p. 360.

Fitzinger, L. J. 1867. Sitzungsber. Akad. Wien, LVI.

Gay, C. 1847. 'Hist. Nat. Chile,' Zool. I, and Atlas.

Geoffroy St. Hilaire, E., and Cuvier, F. 1830. 'Hist. Nat. des Mammifères,' VII, livr. 63, Pl. 258 (Vol. III, of Amer. Mus. set).

Goldman, E. A. 1913. Smiths. Misc. Coll., LX, No. 22.

1916. Proc. Biol. Soc. Wash., XXIX, p. 127.

1920. Smiths. Misc. Coll., LXIX, No. 5.

Gray, J. E. 1873. Ann. Mag. Nat. Hist., (4) XII, pp. 416–419.

Gyldenstolpe, N. 1932. Arkiv. f. Zool., Stockholm, XXIV *b*. No. 1.

Hensel, R. 1872. Abh. k. Akad. Wiss. Berlin.

Hollister, N. 1914. Proc. Biol. Soc. Wash., XXVII, pp. 103–106.

Hopwood, A. T. 1926. Ann. Mag. Nat. Hist., (9) XVII, pp. 328–330.

Ihering, H. von. 1894. 'Os Mammiferos de São Paulo.'

International Rules of Zoological Nomenclature 1926. Proc. Biol. Soc. Wash., pp. 75–104.

Leche, W. 1886. Zool. Jahrb. I, pp. 687–702.

Liais, E. 1872. 'Climats, Geologie, Faune et Geographie Botanique du Brésil.'

Lichtenstein, H. 1830. 'Darstellung neuer oder wenig bekannter Saugethiere . . . '

Lilljeborg, W. 1866. 'Syst. Ofversigt gnagende Daggdjuren, Glires.'

Lund, P. W. 1841. Selskabs k. danske, Vid. Skrifter, (4) VIII, p. 276.

Major, C. I. F. 1901. Ann. Mag. Nat. Hist., (7) VII, pp. 204–206.

Merriam, C. H. 1901. Proc. Wash. Acad. Sci., III, pp. 559–563.

Miller, G. S., Jr. 1911. Bull. U. S. Nat. Mus., LXXIX.

Miller, G. S., Jr., and Rehn, J. A. G. 1902. Proc. Boston Soc. Nat. Hist., XXX.

Osgood, W. H. 1914. Field Mus. Nat. Hist., Zool. Ser., X.

1915. Field Mus. Nat. Hist., Zool. Ser., X.

1931. Field Mus. Nat. Hist., Zool. Ser., XVIII, No. 5.

Pallas, P. S. 1778. 'Nov. Spec. Quadr. e Glires Ordine, etc.'

Pelzeln, A. von 1883. Verh. Zool.-Bot. Ges. Wien, XXXIII, Beiheft, pp. 1–136.

Pennant, T. 1771. 'Synopsis Quadrupeds,' p. 247.

Peters, W. 1860. Monatsber. Ak. Berlin, pp. 135–136, 774.

1866. Monatsber. Ak. Berlin, pp. 404–409.

PHILIPPI, R. A. 1900. Anales Mus. Nac. Chile, No. 14, pp. 1–70.

PICTET, J.-J., AND PICTET, C. 1844. 'Notices sur les Animaux nouveaux ou peu connus du Musée de Genève.' Separately published. [Parts 3 and 4 of series, of which parts 1 and 2 appeared in Mem. Soc. Phys. Hist. Nat. Genève, IX and X.]

POCHE, F. 1904. Zool. Annalen, I, pp. 47–49.

RIBEIRO, A. DE MIRANDA 1914. Comm. Linhas Tel. . . Annexo 5, pp. 1–49.

SANBORN, C. C. 1929. Field Mus. Nat. Hist., Zool. Ser., XVII, pp. 147–165.

TERTRE, PERE DU 1667. 'Histoire generale des Antilles,' II, pp. 301–302.

THOMAS, O. 1882. Proc. Zool. Soc. London, p. 101.

1884. Proc. Zool. Soc. London, p. 449.

1896. Proc. Zool. Soc. London, pp. 1012–1028.

1897*a*. Science, (2) VI, pp. 485–487.

1897*b*. Ann. Mag. Nat. Hist., (6) XIX, pp. 494–501.

1897*c*. Ann. Mag. Nat. Hist., (6) XX, pp. 544–552.

1899*a*. Ann. Mag. Nat. Hist., (7) III, pp. 40–44.

1899*b*. Ann. Mag. Nat. Hist., (7) IV, pp. 278–288.

1901*a*. Ann. Mag. Nat. Hist., (7) VIII, pp. 139–154.

1901*b*. Ann. Mag. Nat. Hist., (7) VIII, pp. 246–255.

1903. Proc. Zool. Soc. London, pp. 232–244.

1905. Ann. Mag. Nat. Hist., (7) XV, pp. 584–591.

1906*a*. Ann. Mag. Nat. Hist., (7) XVIII, pp. 442–448.

1906*b*. Ann. Mag. Nat. Hist., (8) VI, pp. 184–189.

1909. Proc. Zool. Soc. London, pp. 669–670.

1910. Ann. Mag. Nat. Hist., (8) VI, pp. 184–189.

1913. Ann. Mag. Nat. Hist., (8) XII, pp. 567–574.

1917. Ann. Mag. Nat. Hist., (8) XX, pp. 95–100.

1920. Ann. Mag. Nat. Hist., (9) V, pp. 473–478.

	1921.	Proc. U. S. Nat. Mus., LVIII, pp. 217–249.
	1927.	Ann. Mag. Nat. Hist., (9) XIX, pp. 361–373.
	1928.	Ann. Mag. Nat. Hist., (10) II, pp. 249–265.
TROUESSART, E.-L.	1881.	Le Naturaliste, I, pp. 355–357.
	1885.	Ann. Sci. Nat. Zool. and Pal., XIX, Art. 5.
	1898.	'Cat. Mamm. viv. foss.'
	1903.	Ann. Mag. Nat. Hist., (7) XI, pp. 386–388.
	1905.	'Cat. Mamm. viv. foss., Supplement.'
WAGNER, A.	1841.	Arch. f. Naturg., I, p. 111.
	1842.	Arch. f. Naturg., I, pp. 17, 288.
	1843.	Schreber's 'Saugethiere,' Supplement III.
	1845.	Arch. f. Naturg., I, p. 147.
	1850.	Abh. Ak. Munchen, V, pp. 306, 312.
WATERHOUSE, G. R.	1837.	Proc. Zool. Soc. London.
	1839.	'Zoology Voyage "Beagle." '
WINGE, H.	1887.	E. Mus. Lundii, I, part 3.
WOLFFSOHN, J. A.	1910.	Bol. Mus. Nac. Chile, II, pp. 84–102.
ZIMMERMANN, E. A. W.	1777.	'Spec. Zool. geogr. . . . ' p. 509.

AMERICAN MUSEUM NOVITATES

Number 563 | Published by The American Museum of Natural History New York City | Sept. 17, 1932

59 54,4 P

A NEW GENERIC NAME FOR *CORIARACHNE VERSICOLOR* KEYSERLING, WITH NEW SPECIES

By W. J. Gertsch

The first species of this group was described as a *Coriarachne* by Keyserling ('Die Spinnen Amerikas,' Laterigradæ, 1880), an error in generic placement that has persisted even to the present time in our literature. Simon ('Histoire Naturelle des Araignes') was the first to show its untenableness in that genus and relegated it to *Xysticus*, where it has been retained by most modern arachnologists. Later Banks described two more species of the group and placed them in *Coriarachne*, in which he was followed by Emerton in his 'List of Canadian Spiders.'

The discovery in collections of these three described species and another from the southwestern part of the United States has led me to redefine the genus and figure the palpi of the males. They form a compact group with no intergrades to allied genera, closely related to but generically distinct from *Xysticus*. Keyserling's species comes from the eastern part of the country, *P. brunneipes* (Banks) from the northern Pacific coast and Canada, *P. floridanus* (Banks) from Florida and Mississippi, and the new species described below is widely distributed in the Rockies, west to the Pacific coast, and undoubtedly found in western Canada (Emerton, *C. versicolor*, 'List of Canadian Spiders').

All the species are closely related but distinct in the tibial apophyses, length and character of the tubes of the palpi, and in other structural details. The females are more difficult to place, and as yet I have not seen representatives of that sex for Banks' species.

Platyxysticus, new genus

A misumenoid genus closely allied to *Xysticus*.

Carapace as broad or broader than long, very flat, about the same height throughout, width at the front more than half the greatest width. Eyes in two rows, the first only slightly recurved, the medians much smaller and somewhat nearer to the laterals, second row more strongly recurved, the medians small, slightly nearer each other than the laterals. Median quadrangle a little broader

than long, the anteriors larger. Clypeus vertical, about twice the height of an anterior median eye. Leg formula 2143.

GENOTYPE.—*Coriarachne versicolor* Keyserling.

The genus defined above differs from *Xysticus, Ozyptila, Bassania*, etc., chiefly by the very flat carapace, the much narrower clypeus, and the different leg formula.

KEY TO MALES

Tip of embolus acutely turned dorso-laterally; upper dorso-lateral process lacking fine spur... *P. brunneipes* (Banks).
Tip of embolus directed posteriorly; upper dorso-lateral process with fine spur.
Tube of embolus almost attaining the upper dorso-lateral process, the spur of which is curved.. *P. versicolor* (Keyserling).
Tube much shorter; spur nearly straight.
Bulb about as broad as long................................*P. floridanus* (Banks).
Bulb distinctly longer than broad.......................*P. utahensis*, new species.

Platyxysticus brunneipes (Banks)

Figure 4

Coriarachne brunneipes BANKS, 1893, Journ. N. Y. Entom. Soc., I, p. 133.

Coriarachne brunneipes PETRUNKEVITCH, 1911, 'Synonymic Index—Catalogue . . . ,' Bull. Amer. Mus. Nat. Hist., XXIX, p. 403.

Coriarachne brunneipes EMERTON, 1920, Trans. Royal Canadian Institute XII, p. 334.

Described from a male from Mt. Constitution, Washington, collected in 1929 by Ralph W. Macy.

MALE PALPUS.—Tibia with two apophyses, the lower retro-lateral one farther separated from the upper than in the other species, placed almost at right angles to the tibia, the upper retro-lateral apophysis completely lacking the small spur so characteristic of the others. Embolus basally heavy, distally acutely turned dorso-laterally in a sharp, fine spur.

"The epigynum consists of a cavity much narrower behind, similar in plan to that of *Gnaphosa*, from the anterior margin there is a projection with a rounded posterior margin, which nearly covers the anterior portion of the cavity." (Banks, 1893.)

RANGE.—Type locality: Washington State (quite common).

OTHER RECORDS.—Seattle, Olympia, Washington; coast of Oregon; California; Banff, Alberta; Victoria, B. C.

Platyxysticus floridanus (Banks)

Figure 3

Coriarachne floridana BANKS, 1893, Trans. Amer. Ent. Soc., XXIII, p. 71.

Coriarachne floridana PETRUNKEVITCH, 1911, 'Synonymic Index—Catalogue . . . ,' Bull. Amer. Mus. Nat. Hist., XXIX, p. 403.

Described from a male from Mississippi.

MALE PALPUS.—Tibia with two apophyses, the small spur on the upper retrolateral one straight as in *P. utahensis*, new species. Bulb a little broader than in *P. versicolor*, the embolus shorter, somewhat sinuate.

Female unknown.

RANGE.—Type locality: Punta Gorda, Florida.

OTHER LOCALITY.—Mississippi.

This species is larger than *P. versicolor* and has larger anterior lateral eyes. In color and structure it is nearer *P. brunneipes*, from which it differs mainly in the palpal organ.

Platyxysticus versicolor (Keyserling)

Figure 1

Coriarachne versicolor KEYSERLING, 1880, 'Die Spinnen Amerikas,' Laterigradæ, p. 53, Pl. I, fig. 27.

Coriarachne versicolor EMERTON, 1892, Trans. Conn. Acad. Sci., VIII, p. 367, Pl. XXIX, fig. 7.

Xysticus versicolor SIMON, 1895, 'Histoire Naturelle des Araignes,' I, p. 1035.

Xysticus versicolor EMERTON, 1902, 'Common Spiders,' p. 34, Figs. 99, 100.

Xysticus versicolor SIMON, 1903, Bull. Mus. Paris, IX, p. 386.

Xysticus versicolor PETRUNKEVITCH, 1911, 'Synonymic Index—Catalogue . . . ,' Bull. Amer. Mus. Nat. Hist., XXIX, p. 442.

Coriarachne versicolor EMERTON (part), 1920, Trans. Royal Canadian Institute, XII, p. 334.

Described from a male from Minneapolis, Minnesota.

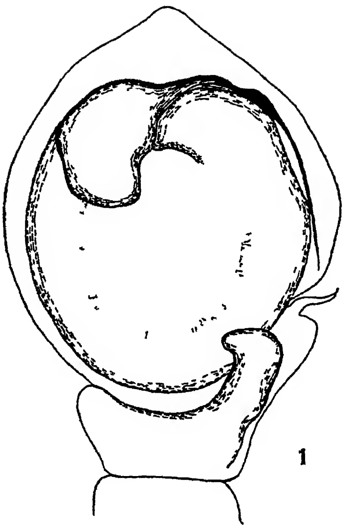
MALE PALPUS.—Tibia with two apophyses as in the other species of the genus, the small spur on the upper retro-lateral one curved laterad. Bulb proportionately much broader than in *P. utahensis*, the embolus sinuate, much longer, distally very acuminate.

Epigynum much like that of *P. utahensis*, new species.

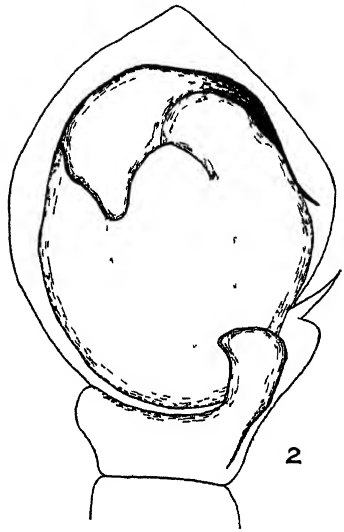
RANGE.—Type locality: "Diese Art scheint über ganz N. Amerika verbreitet zu sein. In der Sammlungen der Herren E. Simon und Dr. Koch, befinden sich Exemplare aus Mariposa in Californien, aus Boston, Georgia und Peoria im Staate Illinois."

I have seen specimens from practically every state east of the Rockies.

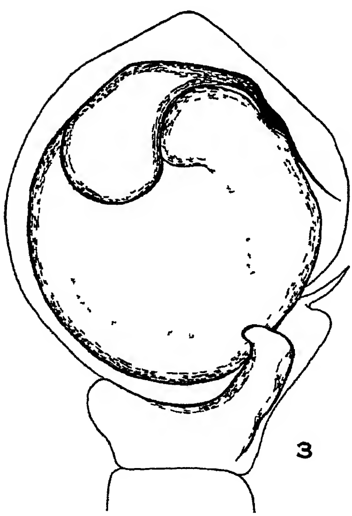
To this species have been referred most of the records of these spiders in the United States. Keyserling's figure and description show undoubtedly that he was dealing with the form widely distributed east of the Rockies, and his specimen from Mariposa, California,



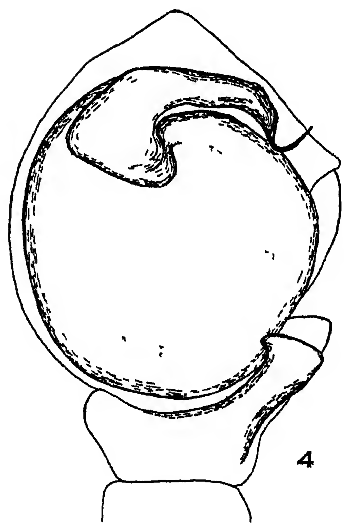
1



2



3



4

Fig. 1. Ventral view of palpus of *Platyxysticus versicolor* (Keyserling).
Fig. 2. Ventral view of palpus of *Platyxysticus utahensis*, new species.
Fig. 3. Ventral view of palpus of *Platyxysticus floridanus* (Banks).
Fig. 4. Ventral view of palpus of *Platyxysticus brunneipes* (Banks).

is unquestionably the new species described here. *P. versicolor* has also been reported from various localities in Canada, but only those from the eastern part are referable to this species.

Platyxysticus utahensis, new species

Figure 2

FEMALE.—Color: Carapace yellow to white, thickly suffused with brown and black streaks and blotches that nearly obliterate the lighter color, with only a faint indication of a median longitudinal light band or just as commonly without any such indication. Posterior eye row enclosed in a darker brown region, the eye tubercles brown. Margins of carapace darker, near black, two large black irregular blotches at each side of the median cephalic furrow. Clypeus and anterior eye row lighter, speckled in brown, the eye tubercles yellow. Cheliceræ yellow with a dark marking near the distal end, otherwise heavily marked in brown. Sternum yellow, thickly blotched with brown and black, heaviest on the margins. Labium and maxillæ an even brown. Coxæ dark to light brown with a median lighter streak below. The basal color of all the legs and palpi is yellow to white, but they are so thickly marked with brown and black spots that in many cases all the lighter color is missing. At the distal end of the femora on all the legs above is a large black maculation. The other joints are more or less speckled with smaller blotches. The anterior legs are darker than the posterior.

Abdomen gray, the margins near black, pattern usually indefinite, or with two or three pairs of large white blotches on the dorsum, the venter irrorate in brown. Spinnerets brown basally, distally gray.

Structure: Cephalothorax with only a few marginal spines and those most numerous and longest in the clypeal region, otherwise with many very short setæ generally distributed over the carapace. Carapace low and flat, about the same height throughout, cephalic sutures fairly well defined, the sides gently rounded to the margins. Carapace only slightly broader than long, suborbicular, anteriorly constricted, posteriorly truncated, the sides rounded, longer than the femur of the first leg, about as long as the femur and patella of the third leg, the width of the head at the front more than half its width at widest point.

Eyes of the first row recurved, the medians more than a third but less than half as large as the laterals, nearer to the laterals than to each other. Eyes of the posterior row recurved, the medians smaller than the laterals, slightly nearer to each other than to the laterals which are larger than the anterior medians but smaller than the anterior laterals. Median ocular quadrangle as wide in front as behind, considerably broader than long, the eyes about equal. Clypeus vertical, less than the height of the ocular quadrangle, a little more than twice the diameter of an anterior median eye, armed on the margins with six or seven spines.

Cheliceræ as long as the last tarsus, the inner margins set with long black setæ. Sternum longer than wide, truncate in front, rounded on the sides, bluntly pointed behind, set with black spines and shorter hairs. Labium decidedly longer than wide, three-fourths as long as the maxillæ, basally truncate, gradually narrowing to the apex, which is rounded, armed with black hairs and spines. Maxillæ

nearly twice as long as wide, excavated somewhat on the inner margins, apices slightly convergent, acute, armed with a band of white hairs, otherwise set with black hairs and spines.

Legs heavy, the first leg slightly shorter than the second, the fourth pair slightly longer than the third, the last two considerably shorter than the first two. The first tibia with five pairs (sometimes four or six) beneath, the second with four pairs, the third and fourth with three pairs of spines. The first and second metatarsi with five pairs of spines beneath, the last two with three pairs.

Abdomen as long as wide, rounded behind, truncated in front, rounded on the sides, set with short spines.

Total length, 6.96 mm.

Cephalothorax, 3.60 mm. long; 3.68 mm. wide; 1.92 mm. wide in front.

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	3.20	1.44	2.16	1.92	1.12	9.84 mm.
II	3.36	1.44	2.20	2.08	1.12	10.20 mm.
III	2.40	.96	1.44	1.12	.80	6.72 mm.
IV	2.24	.96	1.60	1.28	.80	6.88 mm.

Epigynum: Vulva presenting two slitlike openings divided by a broad median septum. The seminal receptacles (as seen through the integument) quite large, broadest anteriorly, extending nearly to the genital furrow. The openings of the fertilization canals appear as two dark spots midway between the genital furrow and the vulva.

Male.—The color in this sex is as in the female but invariably darker, the carapace with an indistinct median light area and darkest on the margins. It agrees also in structure but is somewhat smaller. The clypeus is vertical and equal in height to about twice the diameter of an anterior median eye.

Total length, 6.00 mm.

Cephalothorax 2.96 mm. long; 3.12 mm. wide; 1.44 mm. in front.

Leg	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	3.28	1.28	2.40	2.40	1.04	10.40 mm.
II	3.52	1.28	2.56	2.56	1.12	11.04 mm.
III	2.48	.88	1.60	1.44	.80	7.20 mm.
IV	2.48	.88	1.76	1.60	.80	7.52 mm.

Male palpus: The femur of the palpus is longer than the tibia and patella which are about equal. The tibia is considerably wider than long and has two processes, a heavy chitinized spur on the lower outer surface, and another of equal size on the upper outer side, the apical continuation of which is long and needle-like. The cymbium is scarcely as wide as long, the tutaculum a simple inconspicuous groove. The embolus is heavy, acuminate, resting in the tutaculum. Neither the median nor the terminal apophysis of the bulb is present.

Range.—Type locality: Salt Lake City, Utah, July 2, 1931, male holotype, female allotype, and male and female paratypes; Bluff, Utah (female paratype); Zion National Park (female paratypes).

Other Localities.—Montpelier, Idaho; Ravalli Co., Montana; Fort Collins, Colorado; Washington State; Creston, B. C.

Discussion.—This is an easily recognized species that is found commonly throughout the southwestern part of the United States. Specimens from southern Utah are somewhat lighter than those from the northern part of the state. Unlike the species of *Xysticus*, no median lighter longitudinal band is present on the carapace. Most of the specimens I have taken came from near the habitations and buildings of man. The flat body is well adapted for the cracks and small apertures in wooden buildings. In nature these spiders are found under the bark of trees, under rocks, and in natural debris. Undoubtedly most of the records of *X. versicolor* (Keyserling) from the western United States are referable to this species.

AMERICAN MUSEUM NOVITATES

Number 564 | Published by The American Museum of Natural History New York City | Sept. 20, 1932

59 56,1 P (88)

A NEW AND EXTRAORDINARY GENUS OF THE DIPLOPOD FAMILY, POLYDESMIDÆ, FROM BRITISH GUIANA

By Filippo Silvestri

While examining a collection of diplopods from British Guiana belonging to The American Museum of Natural History, kindly submitted to me for study by my friend and colleague, Dr. Roy W. Miner, Curator of Living Invertebrates, my attention was attracted by two specimens of Polydesmidæ which, upon closer examination, revealed very extraordinary characters differing from all the other known genera of the group, and, because of the extruded stigmata, from all hitherto described diplopods, as well. Therefore I describe these specimens as representative of a new species, new genus, and new subfamily.

The summarized characters follow.

Pandirodesmus, new genus

Figures 1 to 5

Corpus capite, collo, valvulis analibus et segmentis aliis 19 constitutum, trunci segmentis secundo et tertio quam cetera angustioribus, decimo primo ad decimo tertio latioribus et posticis attenuatis, nec in globum nec in spiram (vel parum) contractile.

Derma molle (an semper ?).

Caput manifestum, mandibularum stipitibus inclusis quam collum fere duplo latiore fronte bene convexa, clypeo profunde tridentato.

Antennæ breves articulo primo brevi, secundo quintum longitudine æquante, tertio quam secundus aliquantum breviore et quam quartus paullum longiore, articulo sexto quam quintus parum magis quam dimidio breviore et quam septimus c. ⅓ longiore, setis et sensillis vide Fig. 2*c*.

Mandibulæ (Fig. 2*e* et *f*) stipitibus[1] magnis, partis præmandibularis dente apicali externo acuto laminam dentatam haud superante, lamina dentate dente acuto et dentibus duobus minoribus lobuliformibus instructa, laminis pectinatis 6, mola excavata cercine supero arcuato et lamina cercini superposita et idem interne aliquantum superante instructa.

Hypostoma (Fig. 2*b* et *g*) palpulis maxillaribus externis elongatis, quorum externus quam internus angustior est, palpulo maxillari interno brevi apice subconico.

[1]Silvestri, F., 'Classis Diplopoda,' I, Anatome, Portici, 1903; see also, Berlese, 'Acari Myriopoda et Scorpiones', see also, 1916, Contribuzione alla conoscenza degli Stemmiuloidea (Diplopoda),' Boll. Lab. Zool. Sc. Agr. Portici, X, pp. 288–312.

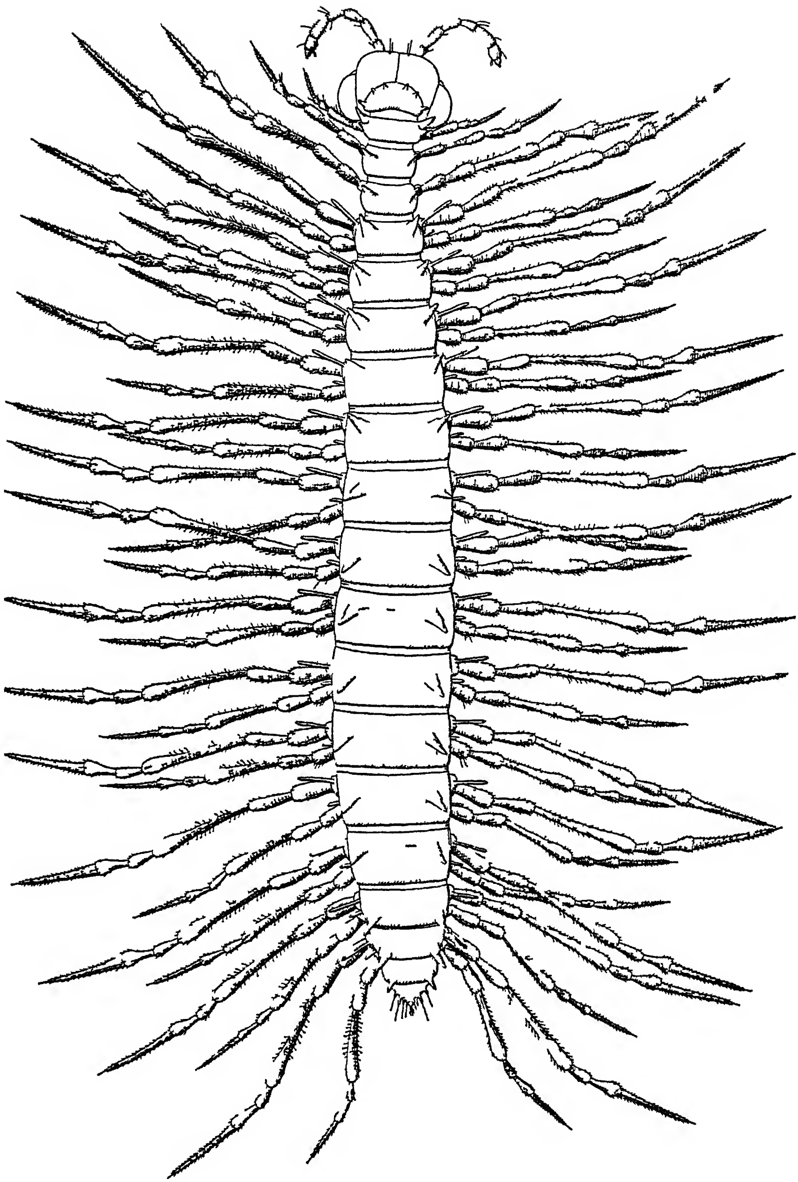


Fig 1 *Pandirodesmus disparipes* entire animal, dorsal view Enlarged

Collum subsemiellipticum, convexitate antica, parum magis quam duplo latius quam longius tuberculis conicis 3+3 instructum, quorum submedianum et sublaterale breviora, lateralia parum longiora sunt.

Trunci segmenta a primo ad decimum octavum inclusum metazonis utrimque processu conico supero sublaterali auctis et carinis destitutis, metazona tergiti primi etiam parte laterali antica extrorsum et antrorsum cornus instar elongata. Segmentum primum processu ventrali laterali postico subcylindraceo etiam instructum est et sterno libero; segmentum secundum sterno transversali lato, breviore; segmentum tertium sterno perlato lateraliter magis quam metazonæ parum producto; sterna cetera perlata et ad basim pedum paris anterioris metazonarum libellam lateralem parum producta et ad basim pedum paris posterioris metazonarum libellam lateralem fere attingentia sunt.

Stigmata haud fossulæ instar sunt sed in segmento tertio tubuli instar brevissimi cylindracei super sterni partis sublateralis antica sese aperientes et a segmento quarto ad decimo-octavum tubuli instar vix subconici longiusculi supra pedum basim prominentis et ad pedum paris antici extrorsum et sursum vergentes, ad pedum pars postici extrorsum et parum deorsum vergentes.

Metazonorum limbus adiectus (Fig. 3*g*) mm. 0.156 longus, laminaris longitudenaliter crebre sulcatus et ad mediam longitudinem irregulariter aciculis setiformibus brevibus quam limbi margo posticus brevioribus instructus.

Pedes omnes 7-articulati, primi paris breves tenues, articulo primo quam secundus parum breviore, secundi paris quam primi aliquantum longiores articulo primo breviore, tertii paris quam secundi aliquantum longiores, quarti paris vel segmenti quarti primi paris quam tertii paris aliquantum longiores, quinti paris vel secundi paris segmenti quarti quam quinti c. ⅙ breviores et segmentorum sequentium omnium pedibus paris antici quam postici similiter longioribus; pedes a tertio pare articulo secundo quam primus aliquantum longiore, articulo tertio quam primus et secundus simul sumpti longiore et quam sextus etiam longiore, articulo quarto quam quintus parum breviore, articulo quinto apice dilatato et tuberculo cylindraceo supero trichobotrium brevem gerente instructo, articulo sexto gradatim attenuato apice setis nonnullis prætarsum tractu longo superantibus instructo, articulo ultimo (prætarso) unguiformi perbrevi attenuato, parum arcuato. Pedes omnes setosi, setis maxima pro parte (tarsi parte distali excepta) apice plus minusve ramuloso ut *f–i*, Fig. 4, demonstrant.

Pori repugnatori in segmentis 4, 6, 8, 9, 11, 12, 14–18 (=5, 7, 9, 10, 12, 13, 15–19 Auctorum) super incisionem ad longitudinem mediam anticam processus conici dorsualis sese aperientes.

Segmentum ultimum (Fig. 5) circumlitione supera subtriangulari apice parum elongato subacuto utrimque tuberculis elongatis setiferis 4+4, apice ipso setis consuetis inferis quatuor instructo.

Lamina subanalis brevis, subtriangularis tuberculis setigeris 1+1; valvulæ anales paullum marginatæ tuberculis setigeris 2+2.

Mas ignotus.

Type.—*Pandirodesmus disparipes*, new species.

Observation.—This genus is distinguished among all the genera of the family Polydesmidæ (the suborder or order Polydesmoidea of authors) especially by the prominent tubiform stigmata on each segment begin-

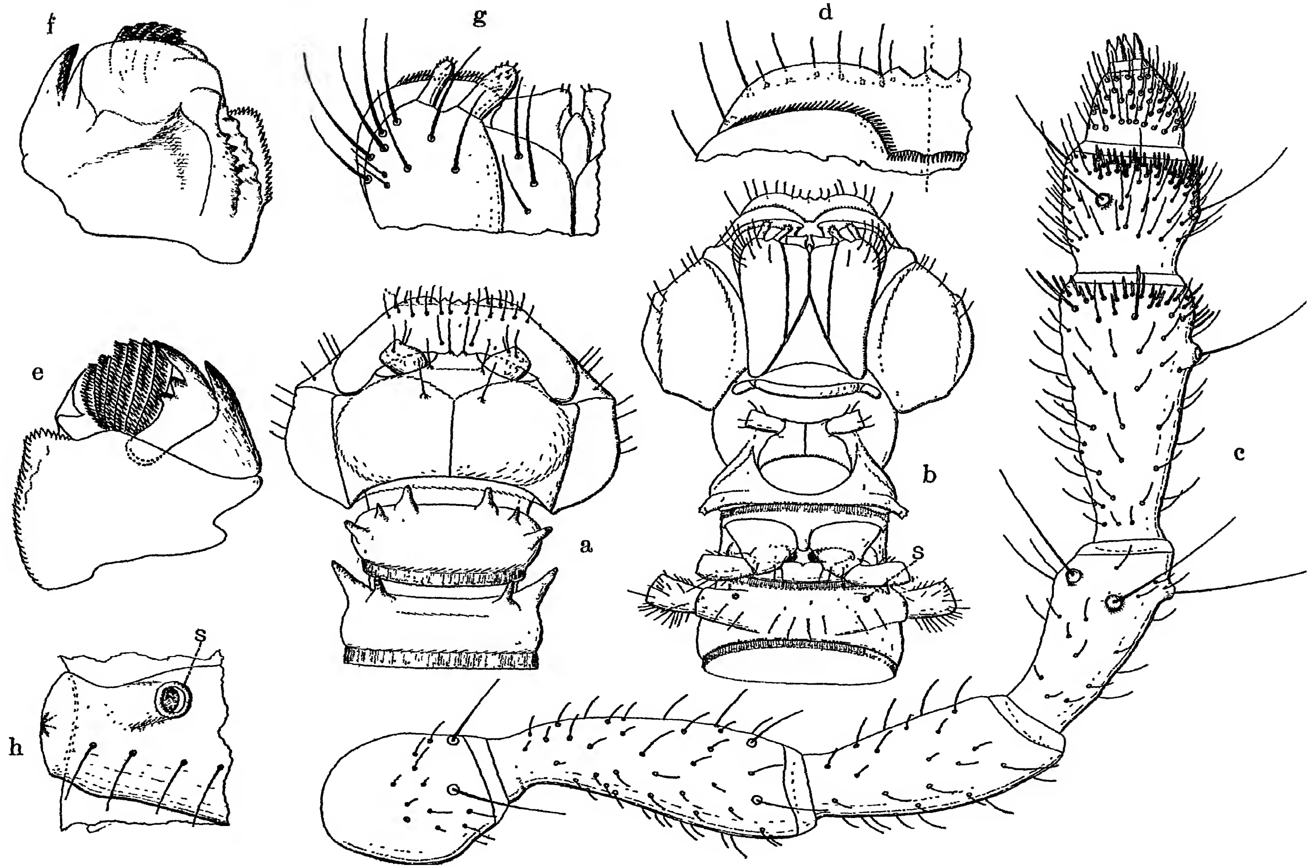

f
g
d
e
a
b
c
S
h
S

Fig. 2. *Pandirodesmus disparipes:* *a*, head, collum, and first segment of trunk, dorsal view; *b*, anterior part of body as far as the third segment of the trunk, including the first joint of the legs, ventral view; *c*, antenna; *d*, clypeus, ventral view; *e*, præmandibula, dorsal view; *f*, præmandibula, ventral view; *g*, one half of hypostoma, distal portion; *h*, one half of third segment, ventral side; *S*, stigma.

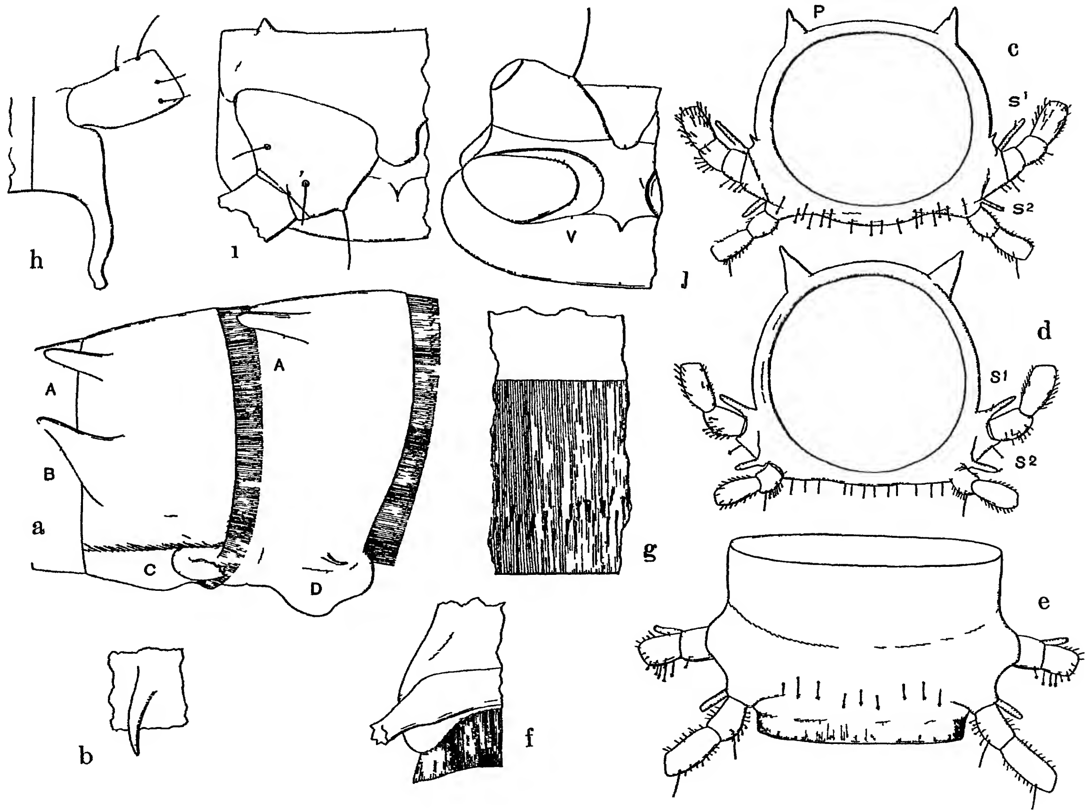


Fig 3

Fig. 3. *Pandirodesmus disparipes;* *a*, first and second segments of trunk, viewed laterally; *A*, dorsal sublateral process of the metazona; *B*, dorsal lateral process; *C*, ventral lateral process of the first trunk segment; *D*, ventral lateral process of the second trunk segment; *b*, ventral lateral process of the second trunk segment, more highly magnified; *c*, twelfth segment viewed anteriorly; *P*, repugnatorial pore; S^1, anterior stigma; S^2, posterior stigma; *d*, the same segment viewed posteriorly; *e*, the same segment viewed ventrally; *f*, posterior lateral ventral portion of the first trunk segment; *g*, posterior part of metazona showing whole adjacent border; *h*, sternum of first trunk segment and first joint of legs; *i*, half of ventral part of second trunk segment with proximal part of legs turned backward; *j*, first joint of same legs turned forward; *V*, vulva.

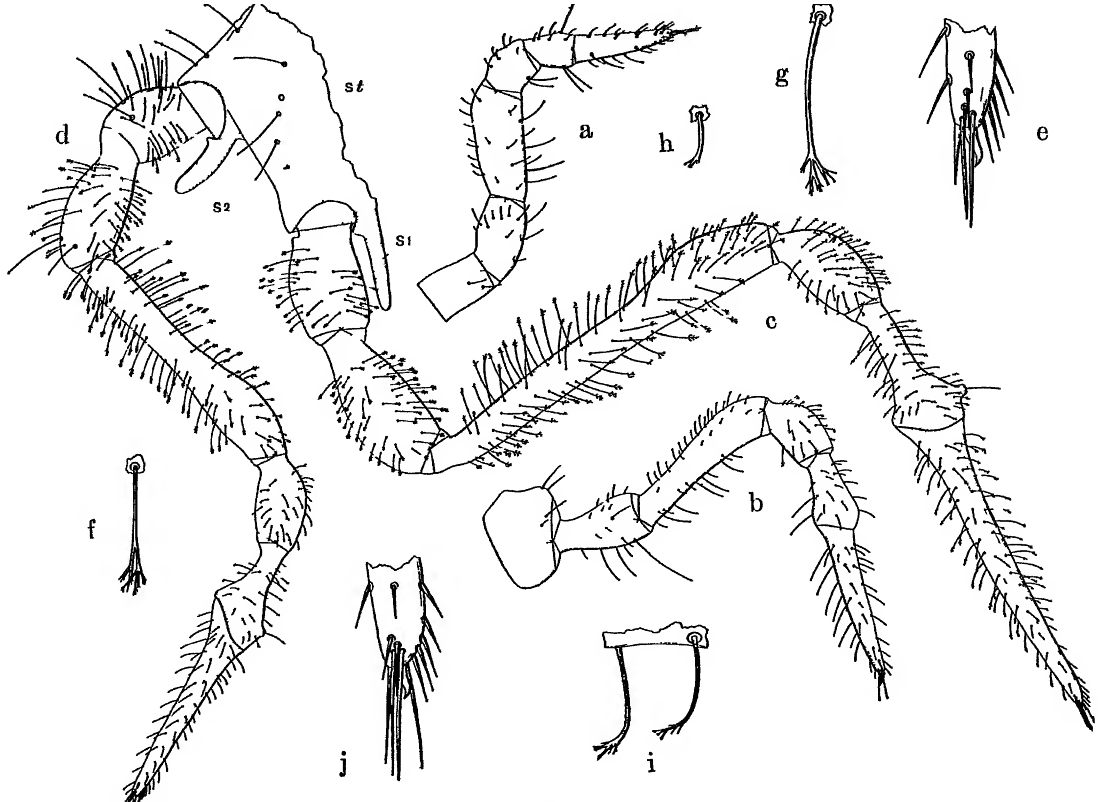


Fig. 4.

Fig. 4. *Pandirodesmus disparipes:* *a*, leg of first pair; *b*, leg of second pair; *c*, leg of the anterior pair of the tenth segment; *d*, leg of the posterior pair of the tenth segment with the sternal plate; *ST*, lateral part of the sternum; S^1 and S^2, anterior and posterior stigmas of the tarsus; *e*, apex of the tarsus and the prætarsus of the anterior pair of legs of the tenth segment; *f*, inferior seta of the second joint of one of the same legs; *g*, inferior seta of the third joint of the same leg; *h*, dorsal seta of the fourth joint of the same leg; *i*, inferior setæ of the proximal part of the sixth joint of the same leg; *j*, apex of the tarsus and the prætarsus of the posterior pair of legs of the tenth segment.

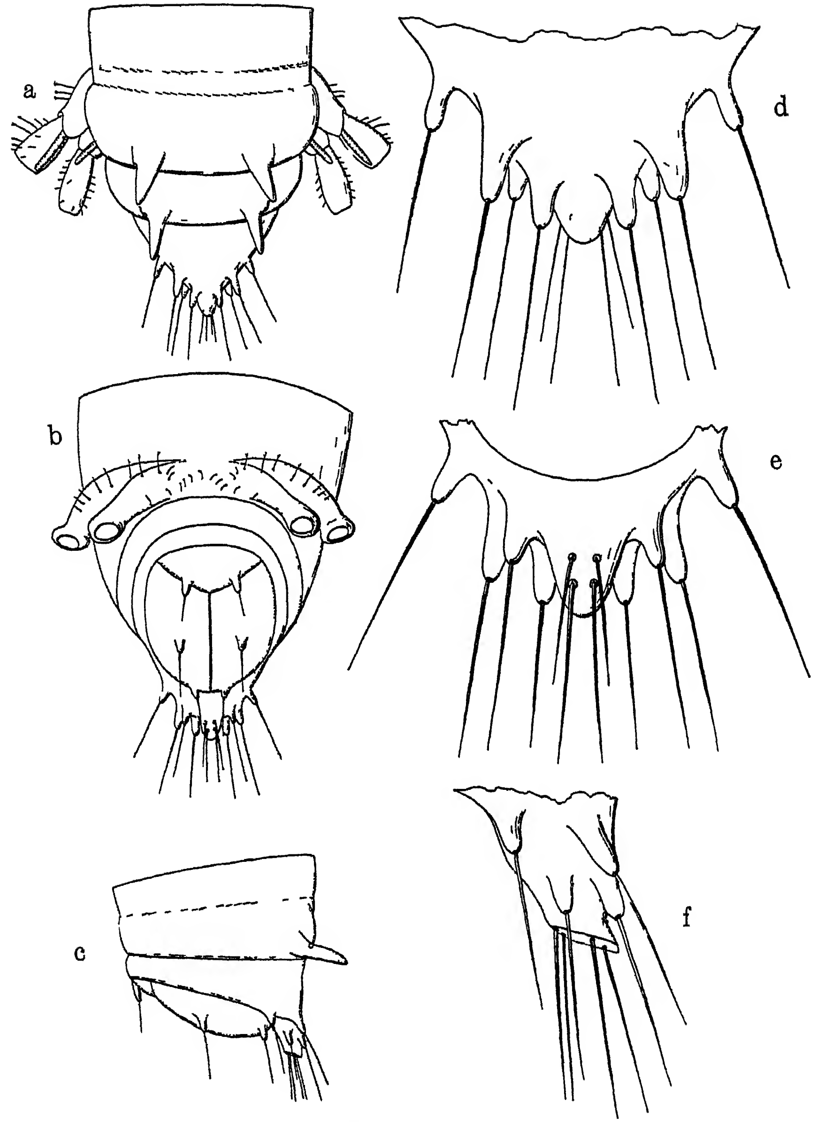


Fig. 5. *Pandirodesmus disparipes: a,* posterior part of body with the first joints of the penultimate and ultimate pair of legs, dorsal view; *b,* the same, ventral view, legs excluded; *c,* the two posterior segments with anal valves, viewed laterally; *d, e, f,* caudal portion of body, dorsal view, and also viewed ventrally and laterally (much magnified).

ning with the fourth; by the anterior pair of feet on each segment, beginning with the fourth, being longer than the posterior pair on the same segment; and by the fact that they arise more laterally than in other genera. Because of these unusually distinctive characters, this genus is hereby ascribed to a new subfamily to be known as **Pandirodesminæ.**

Pandirodesmus disparipes, new species

Corpus totum terreo-isabellinum.

Long. corporis mm. 13. lat. capitis (cum mandibulis) 1.85, long., antennarum 2.20, lat. colli 1.10, lat. trunci segmenti secundi metazonæ 1.20, quarti 1.30, decimi primi 2.10, long. processus dorsualis segmenti secundi 0.45, quarti 0.52, decimi primi 0.40, decimi octavi 0.27, pedum primi paris long. 1.45, secundi paris 2.10, tertii paris 4, quarti paris 4.10, quinti paris 3, long. tubuli stigmatici antici (a segmento quarto) 0.40, postici 0.32.

Notis ceteris vide generis descriptionem et figuras.

Locality.—Kamakusa, British Guiana; collected by Herbert Lang.

Type.—Cat. No. A. M. N. H. 6482, the adult female described with body broken into three parts.

Paratype.—Cat. No. A. M. N. H. 6483, a young female having a segment less than the adult and 10 mm. in length.

Note.—The scarcity of the material has not permitted a more detailed study of this very singular polydesmid, which is remarkable because of tubiform stigmata and the different length of the legs on each segment beginning with the fourth, and for the different insertion of the same. The structure of the apical part of the tarsus and of the pretarsus is very peculiar, the latter being very small and surpassed greatly in length by the apical setæ of the tarsus, but this structure is present in the legs of *Trachelodesmus* Peters also. Until we know the conditions of the place where this strange diplopod lives, we cannot explain in a right manner the structures presented by it, but I suspect that it lives in marshes or on trees among very wet arboreal vegetation, where ventrally opening stigmata would not be adapted for respiration. The structure of the pretarsus indicates, I think, that the animal is not fitted for walking on hard soil.

I hope that after the publication of this note, collectors of arthropods in British Guiana and nearby regions will pay some attention to these creatures, in order to ascertain their habitat and to collect enough material for a complete morphological study.

Systematic Position of Pandirodesminæ

This group of Polydesmidæ is closely related to the Trachelodesminæ with *Trachelodesmus* Peters as type, having a similarity in the

large sterna and in the form of the apical part of the tarsus and of the pretarsus, but there still remain enormous differences in the fundamental characters given above between the Pandirodesminæ and the Trachelodesminæ. Had I followed the present fashion of most living diplopodologists, I should have felt obliged to erect a family, at least, for this group, but as I have become very conservative in the matter of classification, for the present I prefer to consider the Polydesmidæ as a unique family, though other authors would make it of ordinal or subordinal rank. There is no doubt that the Pandirodesminæ represent an isolated group in the family, well worthy of being considered a distinct subfamily. It is noteworthy that so strange a form of polydesmid has kept the most generalized formula of the disposition of the pori repugnatori.

AMERICAN MUSEUM NOVITATES

Published by
Number 565 — The American Museum of Natural History, New York City — Sept. 20, 1932

59.56,1 (8)

DESCRIPTION OF A NEW GENUS AND TWO NEW SPECIES OF SOUTH AMERICAN DIPLOPODA OF THE FAMILY POLYDESMIDÆ

By Filippo Silvestri

Continuing the study of South American myriopods in the large collections of The American Museum of Natural History, I have found a new and striking genus of the family Polydesmidæ, subfamily Strongylisomini,[1] which I describe herewith.

Onciurosoma, new genus

Figures 1 and 2

Corpus segmentorum numero et pororum numero et distributione normale, subcylindraceum, antice paullum postice parum attenuatum.

Caput detectum sulco postico mediano sat profundo; antennæ articulis 2–6 longitudine inter sese parum diversis, articulo sexto quam præcedens aliquantum crassiore sensillis bene evolutis ut Fig. 1 *b* et 2 *a–b* demonstrant.

Collum quam caput (cum mandibulis) parum angustius, convexum.

Trunci metazonæ a quarta supra sulco transverso submediano profundo et sulco longitudinali mediano postico et setis paucis transverse biseriatis instructæ, carinis lateralibus minimis, segmentorum porigerorum vix majoribus (sed segmentorum 17^{i} et 18^{i} vel tantum 18^{i} subnullis), lateribus longitudinaliter profunde sulcatæ, limbo adiecto (Fig. 1 *f*) brevi, laminari, margine postico irregulariter laciniato.

Segmentum ultimum cauda angustata sed postice truncata, angulis posticis unci instar retrorsum et deorsum aliquantum productis et sensillis 4 consuetis medianis instructa.

Sterna latiuscula ad pedum basim inermia vel non, sulco mediano affecta.

Pedes articulo tertio inter ceteris longiore prætarso unguiformi simplici.

Mas.—Sternum inter pedum par quartum aliquantum productum, pedum paris decimi articuli tertio quam ceterorum plus minusve crassiore.

Organum copulativum articulo secundo longo, subrecto, pseudoflagello bene evoluto.

Type.—*O. neotropicum*, new species.

Onciurosoma neotropicum, new species

Figure 1

♀.—Corpus rufo-badium ventre et pedum articulis 1–3 terreis, lævigatum, nitidum.

[1]I am at present very conservative in classification and do not like to follow those specialists who, in my opinion, have tended to erect families for groups which can be considered very well as subfamilies, tribes, or less.

Metazonæ carinis lateralibus angulo postico exciso haud producto, sulco inter præ- et metazonam lævigato, carinis segmenti 18[1] subnullis.

Sterna inermia. Pedes sat tenues, setis numerosis ut *j–k*, Fig. 1, demonstrant instructis.

Segmenti ultimi caudæ unci laterales acuti deorsum et extrorsum parum vergentes; lamina subanalis postice aliquantum rotundata, valvulæ anales marginatæ, setis 2+2 eisdem valvulæ subanali similibus.

Long. corporis ad mm. 18. lat. metazonæ segmenti decimi 1.90, long. antennarum 3.20, pedum paris decimi 2.40.

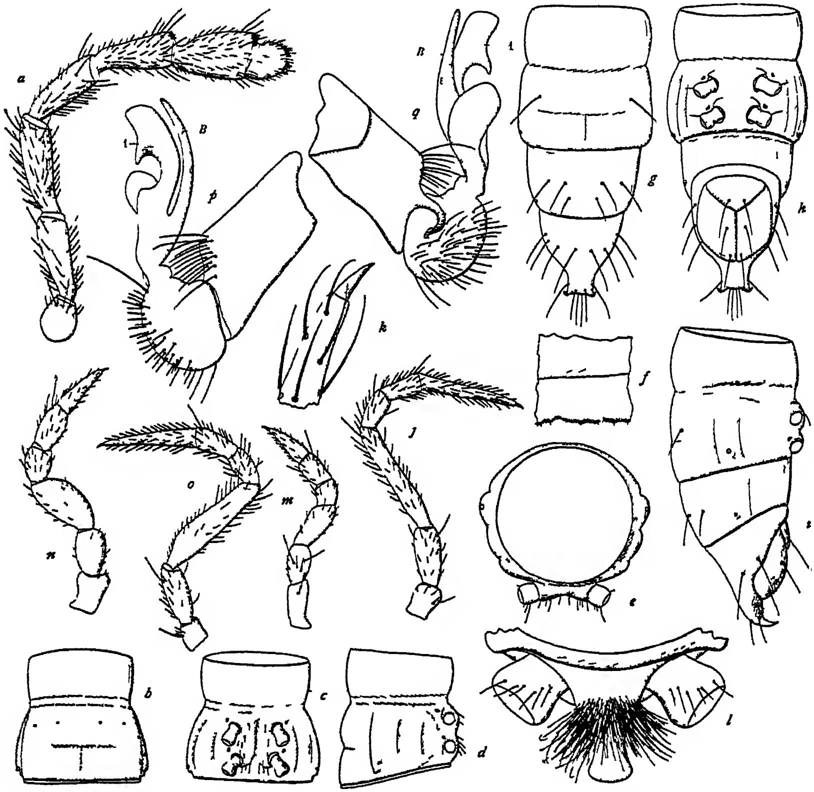


Fig. 1. *Onciurosoma neotropicum:* *a*, antenna; *b–e*, ninth segment of the trunk viewed dorsally, ventrally, laterally, and posteriorly; *f*, a posterior dorsal fragment of the above much magnified; *g–i*, posterior part of the body viewed dorsally, ventrally, and laterally; *j*, a leg of the ninth segment; *k*, distal part of the same much magnified; *l*, the fourth sternum viewed anteriorly; *m–o*, leg of the first, second, and tenth pair of the male; *p–q*, one of the two parts of the copulatory organ viewed from the internal and external aspects (*A*, hasta; *B*, pseudoflagellum).

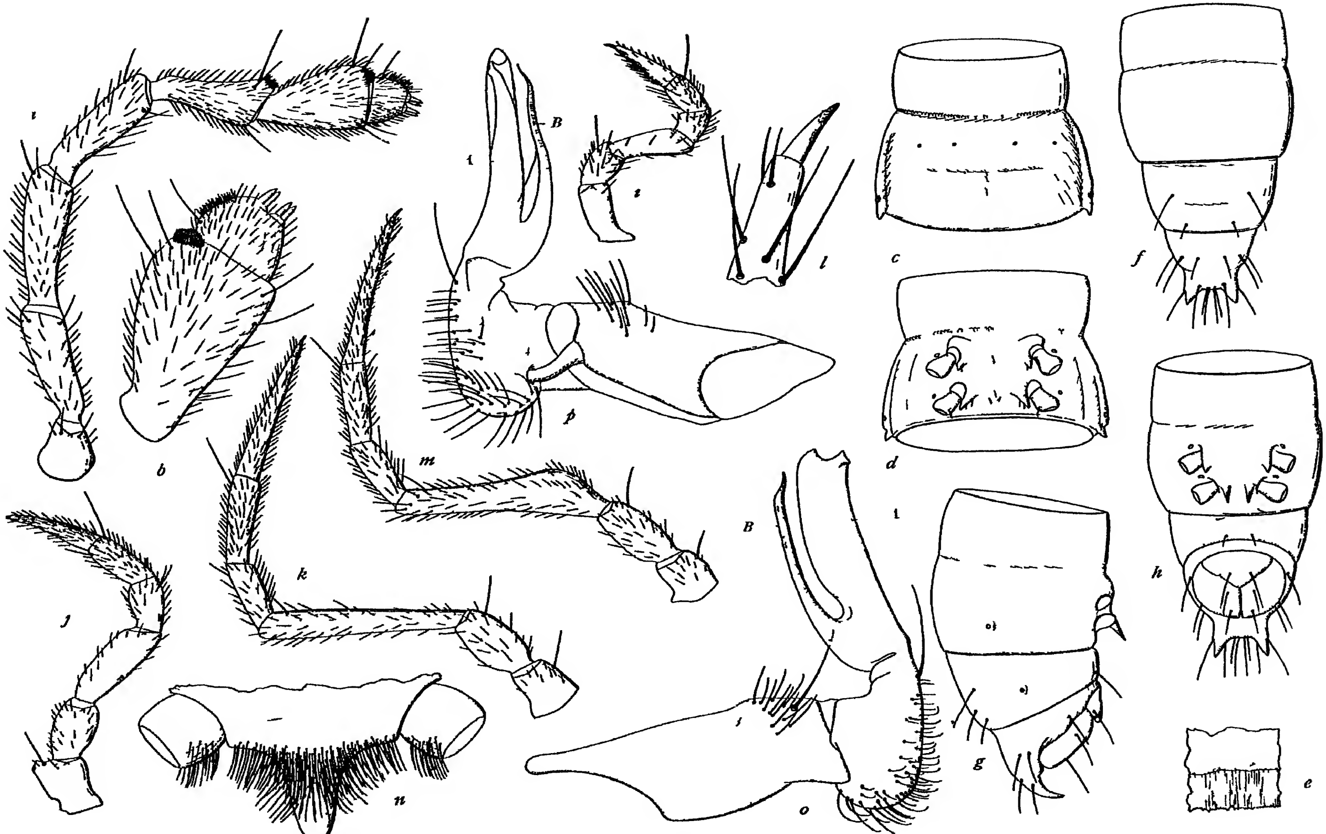


Fig. 2.—Description on p. 4.

♂.—Processus sternalis inter pedum par quartum longulus spathuliformis, pedum articuli primi apicis libellam superans et parte basali persetosa.

Pedes paris decimi articulo tertio parte proximali quam distalis parum crassiore ut Fig. 1 *o* demonstrat.

Organi copulativi (Fig. 1 *p–q*) hasta apice laminari aliquantum dilatato et parum longe ab apice profunde excisa ita ut margo præapicalis anticus subuncinatus apparent pseudoflagello attenuato hastæ apicem attingente, hastæ processu laminare submediano interno latiusculo margine convexo integro.

Locality.—I have examined specimens collected near Vegas Falls on Mt. Duida, Venezuela (near the summit, altitude 4700 ft.), by the Tyler–Duida Expedition of The American Museum of Natural History in 1929.

Type.—Cat. No. A. M. N. H. 6627.

Onciurosoma acisternum, new species

Figure 2

♂.—Corpus testaceum ventre pedibusque terreis, levigatum, nitidum.

Metazonarum carinæ laterales perparvæ sed a segmento quarto ad 15^{um} angulo postico acuto breviter libero, carinis segmentorum 17^{1} et 18^{i} subnullis, sulco inter præet metazonam crenulato, metazonarum dorsum sulco mediano longitudinali obsoleto vix distinguendo ante sulcum transversalem etiam instructum.

Sternum inter pedum par quartum in processum longulum productum, gradatim angustius, apice rotundato, maxima pro parte (apice excluso) setis numerosis instructum, pedum articuli primi libellam superans; sterna a segmento septimo ad basim pedum in processum acutum, breviorem ad pedum par anticum, parum longiorem ad pedum par posticum, producta. Pedes sat tenues setosi, articulo tertio inter ceteros longiore, prætarso unguiformi simplici. Pedes paris decimi articulo tertio parte basali infra aliquantum inflata convexa.

Segmentum ultimum angulis posticis in processibus longiusculis acutis retrorsum et deorsum vergentibus productis; lamina subanalis postice triangularis.

Organi copulativi hasta apice laminari dilatato ut *o–p*, Fig. 2, demonstrant incisa, pseudoflagello hastæ apicem subattingente.

Long. corporis mm. 16, lat. metazonæ segmenti decimi 1.70, long. antennarum 3.00 pedum paris decimi 2.90.

Locality.—Mouth of Meamu River, British Guiana; collected by Herbert Lang and W. J. La Varre.

Type.—Cat. No. A. M. N. H. 6626.

Observation.—This species shows very distinct differences from the preceding in the produced posterior angles of the carinæ, in the sterna being produced near the base of the legs in the form of a spine, and in the form of the reproductive organs.

Fig. 2. *Onciurosoma acisternum,* male: *a,* antenna; *b,* distal part of the same more greatly magnified; *c–d,* ninth segment viewed dorsally and ventrally; *e,* posterior dorsal fragment of the same much magnified; *f–h,* posterior part of the body viewed dorsally, laterally, and ventrally; *i–k,* a leg of the first, second, and ninth pair; *l,* distal part of a leg of the ninth pair more greatly magnified; *m,* a leg of the tenth pair; *n,* sternal portion between the fourth pair of legs viewed anteriorly; *o–q,* one of the two parts of the copulatory organ viewed from external and internal face (the pseudoflagellum, *B,* somewhat removed from the hasta, *A*).

AMERICAN MUSEUM NOVITATES

Number 566 | Published by The American Museum of Natural History New York City | Sept. 21, 1932

56.ſ (118:82,9)

THE SUPPOSED ASSOCIATION OF DINOSAURS WITH MAMMALS OF TERTIARY TYPE IN PATAGONIA[1]

By George Gaylord Simpson

Over a generation has passed since Florentino Ameghino startled the scientific world by announcing that in Patagonia highly developed mammals, including ungulates, such as elsewhere occur only in the Tertiary were contemporaneous with dinosaurs. At first he based this radical opinion on apparent conformity between the dinosaur beds and the generally superposed mammal beds and on supposed cases of actual association or of superposition of dinosaurs over mammals reported by other workers, especially Roth. Later (1906) F. Ameghino announced that his brother, don Carlos, had now found dinosaurs associated with the *Notostylops* and *Astraponotus* faunas.

These discoveries could only be interpreted in one of three ways: (1) The repeated observations were erroneous, or (2) dinosaurs survived into the Tertiary in Patagonia, or (3) mammals comparable in degree of evolution with those of the Tertiary in the rest of the world there lived in the Cretaceous. Ameghino never hesitated between these alternatives. To him these faunas were Cretaceous, and largely on this basis he built a series of elaborate theories, inevitably destined to revolutionize current scientific opinion if found correct. The essence of his view was that Patagonia was the great center from which mammals spread to the rest of the world, but there are also involved almost equally far-reaching views as to phylogeny, palæogeography, molar evolution, and kindred subjects.

With the partial exception of Santiago Roth and some other authorities working in Argentina, this belief has not been shared by other students. The general attitude has been that the observations might be false, and that if true the more reasonable conclusion is that dinosaurs survived beyond the Cretaceous in Patagonia.

In view of the extreme importance of the problem, it is unfortunate that no really serious and adequate attempt to settle it one way or the other has hitherto been made. The literature is large, to be sure, but it is often lacking in factual basis. Much simply denies the possibility or

[1]Publications of the Scarritt Patagonian Expedition, No. 5.

probability of such a thing and questions the accuracy of Ameghino's work. This is neither just nor useful. After the closest study of much of the field and office work of the brothers Ameghino, I am glad to testify that their records of actual observed fact are almost invariably trustworthy. Discrepancies, admittedly frequent, are generally due to differences in interpretation, not in observation. The positive statement that Carlos Ameghino found dinosaurs in the *Notostylops* and *Astraponotus* beds cannot be brushed aside merely because it seems improbable.

Other criticisms may generally be reduced to the statement that later workers have not repeated the recorded discoveries. To these criticisms Ameghino replied truly that one positive observation outweighs innumerable negative statements, and it may be added that no determined and unprejudiced effort to repeat the observations had been made. The *Notostylops* beds, the crucial point in the geologic column, remained almost unstudied save for the Ameghinos' work.

One of the chief aims of the Scarritt Patagonian Expedition of 1930–31 was to reëxamine this whole matter and to attempt to settle it as definitively as possible. To this end over seven months were spent in Patagonia, most of the time being devoted to the uppermost dinosaur-bearing beds and lowest mammal-bearing beds. All of Ameghino's localities and some others were visited, measured profiles taken, and a large collection made. About six months were then spent in Argentine museums studying the Ameghino and Roth Collections as well as the literature. So far as the results bear on the immediate problem of the association of dinosaurs and mammals, they are here summed up. The quite different, less important and simpler problem of the supposed existence of Mesozoic mammals in beds of undoubted Cretaceous or earlier age has been considered in a previous paper. Special acknowledgment of aid and coöperation is due to Drs. M. Doello Jurado, Luís M. Torres, and Angel Cabrera.

RÉSUMÉ

The principal points of inquiry are as follows:

1. Stratigraphic evidence of concordance between dinosaur- and mammal-bearing beds and of the boundary between the two.
2. Examination of individual records of supposed association of dinosaurs and mammals or superposition of dinosaurs over mammals, to determine
   a. The real stratigraphic positions of the fossils in question, and
   b. Their correct taxonomic determination.
3. Efforts to repeat these observations at the given localities.

The results reached are:

1. Mammals of Tertiary type do occur in beds called "Upper dinosaur beds," but this merely shifts the dinosaur-mammal boundary and neither demonstrates nor suggests an actual association. In any given sequence, a considerable interval invariably separates the two, and in this interval there are always erosional unconformities, possibly local, but any one of which may be regional. Continuity cannot be established on lithologic or stratigraphic grounds, and the series is in all probability usually or always discontinuous.

2a. Except in the case of Carlos Ameghino's own observations, the evidence of stratigraphic position of the crucial specimens is certainly not worthy of belief. Carlos Ameghino's determinations of the horizons from which his specimens came are almost surely correct.

b. But the identification of the fossils from the *Notostylops* and later beds determined as dinosaurs is either positively false or so improbable as to merit only erasure from the record.

3. Work at the critical localities, comparable to or even exceeding that involved in the original discoveries, has failed to produce any positive evidence of the mooted association or to repeat the observations of the workers considered unreliable. It has repeated almost exactly the observations of Carlos Ameghino, but lends no support to the interpretations of Florentino Ameghino and suggests alternative interpretations.

STRATIGRAPHY

The Cretaceous-Tertiary stratigraphy of Patagonia is a very complex subject involving far more than the question here considered, and detailed discussion is deferred. Here are presented some preliminary conclusions and observations, the detailed evidence for which will later be given *in extenso.*

The general stratigraphic series of the meseta region west of the Golfo de San Jorge, is shown on page 4.

No one has denied that the Salamanqueano and all below it are pre-Tertiary, nor that the *Colpodon* beds and all above are post-Cretaceous. The stratigraphic problems here raised chiefly concern the presence or absence of unconformities in the intermediate series and the division and palæontological character of the strata between the Salamanqueano and the *Notostylops* beds. The local and dubious non-fossiliferous "Argiles Fissilaires" are not here of great moment.

Almost all authors have considered the sandstones and clays above the Salamanqueano and below the *Notostylops* beds or (where they occur) the "Argiles Fissilaires" as all of Cretaceous age and as containing dinosaurs and no mammals. They were called the upper beds with dinosaurs, "estratos superiores con dinosaurios," by Windhausen and considered as essentially part of the great Chubutiano series ("estratos inferiores con dinosaurios") more or less incidentally differentiated by the Salaman-

Later Tertiary and Quaternary
(here relatively unimportant)

Patagoniano–Marine, probably late Oligocene or Miocene

Terrestrial Tuffs, with at least four distinct mammalian faunas of Tertiary aspect.	*Colpodon* beds (perhaps in part equivalent to the lower Patagoniano). *Pyrotherium* beds *Astraponotus* beds *Notostylops* beds
"Argiles fissilaires," local, non-fossiliferous, of doubtful age and relationships	

Chiefly sandstones and clays, not subdivided by previous work. The "Pehuenche" or "upper beds with dinosaurs" of most recent authors, not the Pehuenche of Ameghino in this region.

Salamanqueano-Marine, probably Senonian, surely Cretaceous.

Very thick and varied continental deposits, the Chubutiano of some recent authors, variously but not yet definitively subdivided. Containing dinosaurs and partly or wholly Cretaceous.

queano marine invasion. Others call them "Pehuenche," implying (on evidence surely inadequate and probably false) correlation with the dinosaur-bearing beds sometimes given that name in Neuquén. All through the literature one finds repeated assurance that they are a unified series containing dinosaurs. This, in the first place, proves to be an unwarranted assumption and in part quite incorrect.

It seems certain that near the center of the great San Jorge basin[1] there are actually terrestrial Cretaceous beds above the Salamanqueano, for here there is evidence (from well records near Comodoro Rivadavia) of a post-Salamanqueano but still Cretaceous marine invasion, above terrestrial sediments. This will be considered in more detail elsewhere, the present point being that in the "Pehuenche" exposures it is possible, I think probable, that some of the lowest sandstones are really Cretaceous, but certainly not all of them are, and in some sections these Mesozoic beds may be thin or absent. Despite repeated assertions, there is a singular lack of real evidence for the occurrence of dinosaurs here. I

[1]A general and perhaps not strictly accurate term meant to include roughly the large area between Bustamante and Puerto Deseado along the coast and extending westward nearly to the Cordillera.

have been unable to find in the literature or by personal communication a single instance of the discovery of an indubitable dinosaur surely in its original burial place in these strata.

The usual evidence is a citation of Ameghino, but the authors fail to note that these are not the beds that Ameghino called "Pehuenche" in this area. He used that name for the beds immediately *below* the Salamanqueano, the summit of the Chubutiano of recent authors, unquestionably containing dinosaurs and surely of Cretaceous age, but not (even according to Ameghino) containing mammals.

There are several records demonstrably false or too vague for serious consideration. An example is the supposed presence of dinosaurs in the "Pehuenche" near the source of the Río Chico at Lago Colhué-Huapí. As shown by Feruglio and Piátnitzky (personal communication and Feruglio 1931, p. 21) these are actually in the Chubutiano, their true position superficially masked by the presence of a fault. Another instance is a dinosaur bone now preserved in the sample department of the Yacimientos Petrolíferos Fiscales at Comodoro Rivadavia said to have come from near Pico Salamanca, where no Chubutiano is exposed, but not found in place and not accompanied by credible confirmatory data. In other cases the level of the dinosaurs found is not determinable in relation to the Salamanqueano and hence of no definite value.

The most reliable record also relates to the region of Pico Salamanca; Huene (1929, pp. 13–14) says ". . . He podido hacer . . . cortas observaciones . . . entre el *Pico de Salamanca* y *Punta Peligro*. . . . En la gran región bañada inmediatamente al norte del Pico de Salamanca; son bien conocidos los 70 metros superiores de las capas de Pehuenche. En gran parte esta sección se compone de arcillas de un gris-blancuzco, constituyendo principalmente dos grandes conjuntos, sub y sobrepuestos, y además cortados en el medio por areniscas blancas, a veces muy gruesas, con fragmentos de huesos y troncos de árboles silicificados. En la arenisca superior hallé aún una garra de saurisquio. . . . (No he visto nada que pueda determinarse fuera de la garra mencionada y tampoco ésta puede ser determinada con precisión)."

This seems by far the most trustworthy record, and it is very possible that there are true terrestrial Cretaceous beds above the Salamanqueano in this area, as well as post-Cretaceous beds of almost identical physical character, but even this record is not definitive. It is accompanied by no positive guarantee as to the determination of the claw, nor any certainty that the level at which it was found corresponds to the actual time when the animal lived. Since the basal Tertiary sands

give every evidence of being redeposited from older sediments, the possibility of derivation of fossils is always to be borne in mind when dealing with such isolated and fragmentary occurrences.

The latest statement on this point is that of Feruglio (1931), whose extensive experience in this area makes him an authority worthy of great credence:

"En realidad, ahora puedo aseverar que ni yo ni mis colegas [of the Dirección General de los Yacimientos Petrolíferos Fiscales] hemos hallado hasta hoy huesos de Dinosaurios en el Pehuenche, o sea en la serie directamente superpuesta al Salamanqueano [and below the mammal-bearing tuffs]. . . . [The author then cites the find of von Huene mentioned above and concludes that it may be a derived fossil] . . . Así que no es del todo improbable que en esta parte de la Patagonia, los Dinosaurios hayan desaparecido antes de la deposición del Pehuenche, o sea durante el Salamanqueano. . . . "

It thus remains to be shown that any of this so-called "Pehuenche" contains dinosaurs. Further, if, as remains quite possible, there are dinosaurs at some places and some levels, this would merely increase the already established probability that the series is not simple, in spite of its usually moderate thickness, but a complex of lithologically more or less similar rocks deposited at two or more quite distinct times.

These sands and clays universally considered as of Cretaceous age until 1931, and still so considered by almost all authorities, do contain mammals. This fact is summarily mentioned in two papers issued since our return to the United States. Piátnitzky (1931) states:

". . . Las areniscas observadas en Cañadón Hondo inmediatamente debajo del complejo tobáceo con mamíferos, contienen también huesos de Mamíferos en dos niveles distintos. Sin embargo, antes de estudiar estos fósiles, sería aventurado llegar a una conclusión con respecto a la edad de las areniscas. De todos modos, su posición estratigráfica muy baja y la semejanza entre su composición litológica y la del Pehuenche propiamente dicho, talvez indiquen su pertenencia al Cretáceo, a la cual época, por consiguiente, deberían referirse los huesos de mamíferos encontrados en las mismas areniscas."

And Feruglio (1931) adds:

"Observaciones recientes del ing. A. Piatnitzky en el valle del Río Chico[1] . . . y del ing. J. Branmayr al norte de Pico Salamanca, han comprobado la existencia de restos de Mamíferos *in situ* en la parte

---

[1]This is the discovery alluded to in the quotation from Piátnitzky above, Cañadón Hondo being tributary to the Río Chico del Chubut.

superior del complejo continental referido al Pehuenche o Pehuenchiano, a unos 20 m. sobre el banco negro superior y a una altura quizás no mayor de 80 m. sobre el Salamanqueano. Estos hallazgos, junto a las consideraciones que he expuesto arriba, ponen en discusión la edad (terciaria o bien cretácea) del Pehuenche, cuya aclaración puede esperarse de un estudio paleontológico."

We made a collection containing many identifiable specimens at the Cañadón Hondo locality (kindly pointed out to us by Ingeniero Piát-

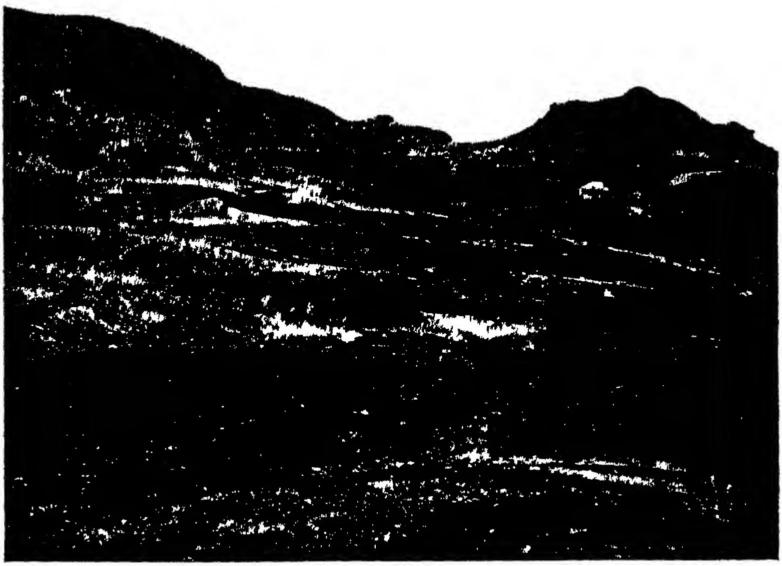


Fig. 1.—In Cañadón Hondo, east of the Río Chico near Paso Niemann. Sandstones and shales commonly referred to the "Pehuenche," but here without dinosaurs and containing Tertiary mammals, some of which were found in the sandstone lens in the right foreground.

nitzky) and we further found mammals at a number of different places in the clay-sandstone series. The lowest were far below those mentioned by Feruglio, less than forty meters above the Salamanqueano. Study is not yet complete, but sufficiently so for present purposes. The mammals are very definitely of Tertiary aspect and close to those of the *Noto-*

stylops beds.[1] Piátnitzky's suggestion of Cretaceous age is not warranted by any evidence save that of lithology, to which I would give no weight at all in this case. It is very usual for a terrestrial formation to have a basal part of material simply *remanié* from an older series and lithologically similar to or identical with the latter. It is the universal experience of all workers from Carlos Ameghino to the present that there are no dinosaurs at least in the upper part of this series. Certainly none has been

Fig. 2.—Supposed angular unconformity at the base of the Tertiary at Cerro Blanco, along the southern margin of the Cuenca de Sarmiento. The "argiles fissilaires" in the foreground are tilted, and the horizontal *Notostylops* Beds of the main cliff seem to overlie them with an angular unconformity, but this is due entirely to slumping, and the two series are actually parallel.

found at the horizons or the localities where mammals occur, and there is no reason to expect them there. In spite of his belief that he found dinosaurs *in* the *Notostylops* beds (as discussed below), don Carlos is very clear (personal communication) that he found none *below* these beds and above the Salamanqueno or in the "basal *Notostylops* beds."

[1]With unusual felicity Ameghino theoretically considered these strata as basal *Notostylops* beds, although he did not definitely record mammals from them. As in several other cases, later workers have gone astray in their refusal to follow his lead.

The boundary between dinosaur beds and mammal beds is not at the base of the tuffs, where it has almost always been placed. It is either within or below the series now called "Pehuenche" by most authors (which here is not really homotaxial with the dinosaur-bearing Pehuenche of the north). This very important shifting of the boundary has wide stratigraphic, faunal, and structural ramifications to be discussed elsewhere. It does not at all advance the case of Tertiary dinosaurs or Cretaceous ungulates.

As regards the presence or absence of unconformities, Keidel, Windhausen and others have claimed that an angular unconformity occurs at the base of the fossiliferous *Notostylops* tuffs. If confirmed, this would

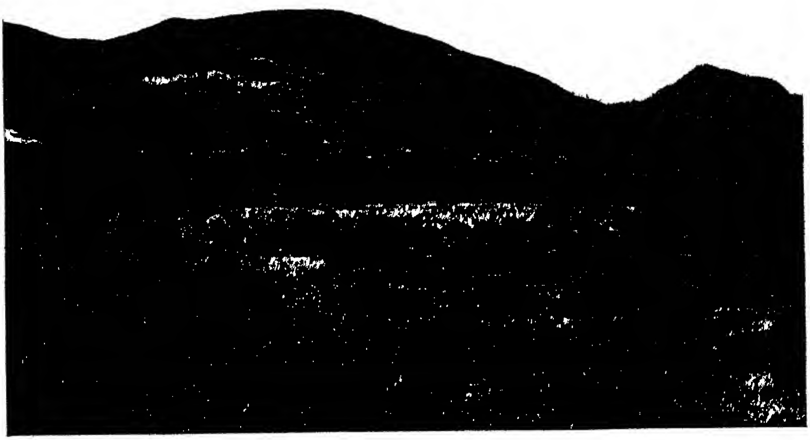


Fig. 3.—So-called "Pehuenche" strata near Punta Peligro, north of Pico Salamanca, showing a characteristic exposure of these fluviatile sediments, with several erosional breaks and an abrupt change from a more brightly colored and more sandy lower part to a paler and more shaly upper part.

not, as they supposed, separate the dinosaur and the mammal beds, but would be within the mammal beds and considerably above the highest level known to contain dinosaurs. In fact, as suspected by Feruglio and as I shall clearly show elsewhere, this unconformity does not exist, or better, is at a very different point in the stratigraphic sequence and does not define a possible Cretaceous-Tertiary boundary. The basal Tertiary and uppermost Cretaceous are essentially parallel in this area.

The major change in type of sedimentation is generally from sandstone and clay to tuff and bentonite and has been thought (on no palæontological evidence) to correspond to the major faunal change. Now this is proven to be untrue. The major faunal change is within or below the sandstones and clays of "Pehuenche" type. In every section examined, there are one or more local, parallel unconformities in this series and minor changes in type of sediments, for instance (near Pico Salamanca) from red or variegated sands with usually minor clay lenses, to thick clays with lenses of pale sands. We have here a continental series with numerous breaks which can be evaluated only on palæontological evidence. It is not valid to follow Ameghino in the belief that the series is continuous. It might be so, but probably is not. As is too well known to need further emphasis, mere parallelism, especially in fluviatile sediments, is no warrant to assume the absence of significant, even very great, gaps in the time record. The purely stratigraphic evidence is inconclusive but is if anything inclined against the inclusion of dinosaur beds and mammal beds in a single formation in any restricted sense of the word.

Much of the discussion regarding the contemporaneity of dinosaurs and the *Notostylops* fauna is merely verbal. One example will suffice. Answering Hatcher's criticism, Ameghino (1903, p. 17) says, "Il [Hatcher] a demandé à Charles [Carlos Ameghino] s'il avait trouvé des débris de mammifères associés à ceux de Dinosauriens, et il lui répondit, non. Si en place de cela, il lui aurait demandé s'il avait trouvé des débris de mammifères dans la même formation qui contient des os de Dinosauriens, certainement il lui aurait répondu, oui." This is clearly and entirely dependent on the use of the word "formation." It is easy to define a formation, as Ameghino did, which will contain dinosaurs (below) and mammals (above), and thus have the two in the same formation, literally, but this does not make them contemporaneous nor does it exclude the probability of a considerable interval between them.[1]

It is, then, unnecessary further to discuss such occurrences in the same "formation" aside from supposed instances of actual field association or superposition of dinosaurs, next to be considered. The newer conceptions of local stratigraphy, here sketched in preliminary outline, change ideas as to the probable Cretaceous-Tertiary contact, but lend no support either to the belief in a single horizon with both dinosaurs and mammals or to the belief in a conformable series with both of these groups.

[1]An analogous case would be the Lance-Fort Union series of our West. These strata could well be, and in some places have been, included in one lithologic formation, which thus could include both mammals of Tertiary type and dinosaurs, but *not* at the same levels.

SUPPOSED INSTANCES OF ASSOCIATION OR SUPERPOSITION OF DINOSAURS

The actual palæontological support for association of dinosaurs and mammals of Tertiary types usually refers to discoveries of dinosaurs in the beds which are characterized by Tertiary mammals, that is, in the *Notostylops* beds (Casamayor Formation) or later formations. These field observations include the supposed discovery of dinosaurs at mammal-bearing horizons and the supposed discovery of dinosaurs in place above such horizons, two types of observations which are essentially the same and, if confirmed, lead to the same conclusion.

These reports I would divide into two very distinct categories as to credibility. First, discoveries by various early workers, usually untrained and demonstrably careless or ignorant, and second, discoveries by Carlos Ameghino, whose intimate and accurate knowledge and generally very careful observations make him a usually very trustworthy witness. It will be found that in the first case the field data are incorrect or otherwise valueless, and that in the second case the field data are generally correct but the identification of specimens is probably or surely at fault. The noteworthy discoveries by others than Carlos Ameghino are:

1. The first remains of *Pyrotherium* were found by Captain Antonio Moreno in the Territory of Neuquén, where they were said to be associated with dinosaurs, the remains of the two having the same aspect. (Ameghino, 1903, p. 19).
2. Remains of a large gravigrade edentate and of dinosaurs were found by Colonel George Rhode in Neuquén, the two being of the same color, aspect, and state of fossilization. Colonel Rhode had also made previous discoveries of the same nature. (Doering, 1882, p. 450; Ameghino, 1885, pp. 153 and 171, 1903, pp. 19–20).
3. Steinfeld and Botello, employees of the Museo de La Plata, found a large mammalian tusk supposedly associated with dinosaurs near Lago Musters. (Moreno and Mercerat, 1890–91, pp. 11–12; Lydekker, 1895, p. 5; Ameghino, 1897, p. 445, 1903, p. 20).
4. Roth claimed to have found mammals of *Notostylops* fauna aspect below a dinosaur (*Genyodectes serus*) near Laguna Pelada in Chubut. (Roth, 1898, pp. 20–21, 1899, p. 382, 1900, p. 263, 1908, p. 96; Ameghino, 1903, pp. 34–36, 1906, pp. 79–80; v. Huene, 1929, pp. 17–18).
5. Roth did find mammals and associated reptiles in sandstone below his so-called "toba cretácea de Dinosaurios" near Gaiman in the valley of the Río Chubut. (Roth, 1899, p. 382, 1908, p. 96 and Plate XVI, Ameghino, 1906, pp. 94–96.)

It is fair and valid to discard the first three observations without much discussion. The field data are lacking or too vague to have any value. In the regions concerned, both *Pyrotherium* and dinosaur-bearing beds are known to occur, but later work has shown them to be at quite

distinct horizons. These horizons were not differentiated by those making the discoveries, who were not trained or even "practical" geologists. The aspect of the fossils, stressed by Ameghino, has no bearing on the problem when not accompanied by other trustworthy data. These three observations must be discarded altogether.

The fourth of the list, the discovery of *Genyodectes serus*, has been adequately discussed by v. Huene (1929, pp. 17–18) who brings out three important points: (a) that the discovery was not made by Roth but by an inexperienced gaucho, (b) that the site is such that the mammals could readily have been derived from a higher horizon than that on which they were found, and (c) that Roth himself was not (in von Huene's opinion) an accurate or able field geologist. The first point in itself invalidates the discovery.

The last citation (5, above) I can myself clearly refute, having studied Roth's collection and visited the locality. Mammals of *Notostylops* fauna aspect were indubitably found at Gaiman in sandstone below the Tertiary tuffs. They are accompanied by reptiles, but Roth himself does not say the reptiles included dinosaurs, and dinosaurs are not, in fact, present in Roth's collection from this locality, now in the Museo de La Plata. Finally, Roth's expression "toba cretácea de Dinosaurios," like the expression "Dinosauriersandstein" later applied to the actual level of the mammals, is used by him as a formation name and neither states nor implies that dinosaurs were actually found in these beds at this locality, and the fact is that they were not so found.

If valid evidence of dinosaurs in the mammal-bearing beds is to be found, it must be in the personal observations of Carlos Ameghino, next to be examined. Authority for reconsideration of these observations is study of all the pertinent materials now in the Ameghino collection, long personal discussion with Carlos Ameghino, detailed field examination of the localities in question, and large new collections from all the geological horizons concerned.

In Ameghino's synthesis of 1903 (pp. 17–45), his arguments are, in brief, (1) that Carlos Ameghino had not found associated mammals and dinosaurs, but (2) that he had found them in the same formation [already discussed above], and (3) that other authorities give instances of such association [also discussed above]. The argument is in part sophistic, in part a valid response to Hatcher's unduly severe and largely inaccurate criticism of Ameghino. The point of most essential value is that at that time Carlos Ameghino had never observed any real or supposed association of dinosaurs and mammals.

In 1906 (p. 80 seq.) Ameghino adds an extremely important point. He can now say what was untrue in 1903, that Carlos Ameghino has now found mammals and dinosaurs not merely in the same (nominal) formation but either at the same level or with dinosaurs above mammals. The actual cases are four in number:

1. At Colhué-Huapí [that is, in the great Barranca (cliff or strip of badlands) south of Lago Colhué-Huapí] a new megalosaur [Ameghino, 1906, Fig. 16] was found in the lower *Notostylops* beds mixed with mammals of that fauna.
2. On the left [northwestern] bank of the Río Chico del Chubut were found remains of dinosaurs of an undetermined and probably new genus associated with mammals in place, including *Carolozittelia tapiroides*.
3. At the same locality remains of *Genyodectes serus* were found at the summit of the *Notostylops* beds above the horizon of *Carolozittelia*.
4. At the same locality *Genyodectes serus* was also found in the *Astraponotus* beds, some forty meters above the level of *Carolozittelia*.

He does not make it absolutely explicit that the last two are separate discoveries, but such was evidently the case. These observations are commonly brushed aside as comparable to the discoveries of Romero, Rhode, etc., but this cannot be done. Here we have circumstantial field data, and the observation was made by an authority to whom his severest critics cannot deny detailed and excellent first-hand acquaint-

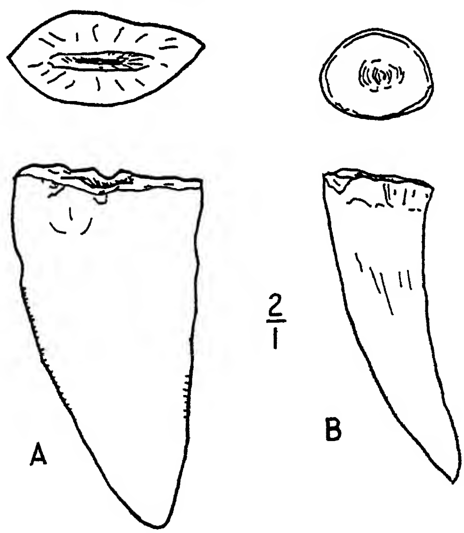


Fig. 4.—Ameghino's supposed dinosaurs from the *Notostylops* Beds. (A), M. N. H. N. No. 10872, from west of the Río Chico. (B), M. N. H. N. No. 10871, from south of Lago Colhué-Huapí Proximal and lateral views. Twice natural size.

ance with the strata and the ability to discriminate between faunas accurately. It is necessary to assume that the specimens in question did come from the stated horizons unless the opposite can be proven.

Regarding (1), this tooth, supposedly of a new megalosaur, is now No. 10871 of the Museo Nacional in Buenos Aires. Ameghino's figure (1906, Fig. 16) represents it accurately save for an exaggeration of the serrations difficult to avoid in a pen drawing. There is no question that this is a crocodile tooth, and not a dinosaur. (See Fig. 4B). It is curious that another tooth (No. 10885) was identified by Ameghino as *Notosuchus terrestris* although it is practically identical save for its smaller size. This observation, then, falls down through incorrect identification.

Regarding (2), (3), and (4), these observations, all at one locality, must be based on at least three specimens (just three, I believe). Only one of them is now to be found in the Museo Nacional. It is No. 10872 and bears the data in Ameghino's hand "Dinosaurio O. Río Chico *Notostylops*," i.e., a dinosaur from west of the Río Chico del Chubut in the *Notostylops* beds. It is probably the tooth referred to in (3), as it is labeled from the *Notostylops* beds and resembles *Genyodectes serus* as closely as it does any other dinosaur. (See Fig. 4A). As this is the only specimen now available, it reasonably becomes a test case on which the whole argument stands or falls, especially as Carlos Ameghino says (personal communication) that the missing specimens were similar in nature.

This tooth was discussed by von Huene (1929, p. 18, paragraph *C*), who states that it was not mentioned recognizably in any of Ameghino's writings. He also states that Carlos Ameghino did not remember finding it, that its horizon was probably judged from preservation and not from the field data, that in any event Carlos Ameghino is only a "prâctico" (unlearned worker by rule of thumb rather than a trained geologist), that Florentino Ameghino several times changed data of origin in successive publications, and that there are no *Notostylops* beds in this region. He agrees that the tooth is dinosaurian but concludes that it came from the "Pehuenche."

It has already been shown that the tooth is mentioned, identified, and its horizon defined by Ameghino (1906, pp. 80–81), and don Carlos (recently recovered from a very severe illness) remembers the discovery distinctly. Its horizon was not judged by preservation, but by field observation and association with mammals of known age. I have already expressed my broadly founded admiration for the work of Carlos Ameghino, not merely as a "prâctico" but practical in the better

English sense of the word. As he rightly insisted in his defense against Hatcher's attack, Ameghino's changes of data were those usual in all work with increasing precision in the distinguishing of separate faunas or faunules. Finally, there certainly are *Notostylops* beds in this region, for we have literally hundreds of specimens from it including *Notostylops*

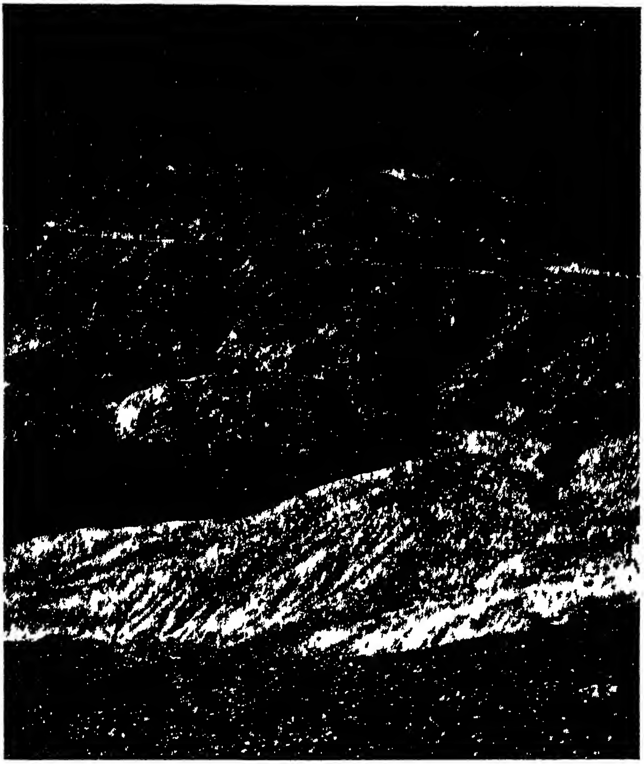


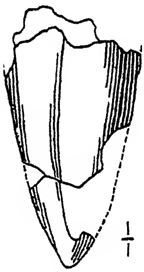
Fig. 5.—*Notostylops* Beds overlying sterile clays in the Oficina del Diablo, Cañadón Vaca. *Florentinoameghinia* was found in the massive bed about fifteen feet thick between the hard bench above, and the thin-bedded sand and tuff below. Typical mammals of *Notostylops* age occur at, slightly below, and through a great thickness above the same horizon.

itself and numerous other genera typical of that horizon. To clinch the matter, we exactly repeated the observation: in this same general region west of the Río Chico we found a tooth nearly identical with that mentioned by Ameghino, still partly buried in undisturbed matrix, with-

in a few inches of mammal teeth and at and above levels with numerous mammals surely of *Notostylops* age.

The stratigraphic data are therefore correct beyond any doubt, and it is necessary to conclude: that dinosaurs do occur in the *Notostylops* beds, that the identification by Ameghino and von Huene is incorrect, or that the specimens are derived from older beds.

Derivation from older beds must be discarded here as very unlikely. The teeth, which are fragile and delicately sculptured, show no signs of rolling. The repetition of the discovery much reduces the chances of secondary derivation. Among the numerous other specimens found, there is none that seems to be derived from older beds. The strata for some distance below do not contain any dinosaurs so far as known. The sediments of this bed differ materially from those of any known dinosaur-bearing beds of the region and give no evidence of containing materials *remaniés* from the latter.



A.M 28401

Fig. 6.—*Florentinoameghinia mystica?*, Amer. Mus. No. 28401, canine tooth probably associated with the type of this species and closely resembling the original of Fig. 4A. Lateral view.

The characters of the teeth themselves are sufficiently clear in the accompanying figures (Figs. 4A, 6). The enamel is very thin, nearly smooth, but with delicate, almost microscopic irregularities. The secant edges are very finely and irregularly serrated. The evidence as to the identification of these teeth may be summed up as follows:

1. The teeth are not exactly like those of *Genyodectes serus* (a true carnivorous saurischian) or of any other known dinosaur. It is equally true that they are not identical with those of any other known group, but they are as much like some mammals as they are like dinosaurs.

2. At least two thousand individual specimens have been collected from the *Notostylops* beds and many others seen but not collected. Among these there is not a single skeleton bone or bone fragment that could possibly belong to a dinosaur. In every known formation surely containing dinosaurs, bones are much more abundant than are teeth.

3. Numerous thin sections were made and carefully studied. These were inconclusive to the extent that no infallible criterion seems to separate all dinosaur teeth from those of any other vertebrates, and particularly mammals, but the enamel structure of these teeth was not exactly matched in any dinosaur examined and was quite indistinguishable from some mammalian sections.

4. Our own specimen was found very close to cheek teeth clearly mammalian. This again is not conclusive, because the same block of matrix contained remains of at least two other mammals, and positive contact could not be established by reunion of the crushed fragments. It is, however, strongly suggestive, because: (a) these cheek

teeth, although scattered in the matrix to some extent, represent a characteristic part of the upper jaw of a single individual, whereas the others present were mere random fragments and were not so near the "dinosaur" tooth; (b) the size relations are fully possible for association of the caniniform and upper cheek teeth; (c) the cheek teeth represent an animal excessively rare in the formation and very peculiar in character, which is likewise true of the caniniform "dinosaur" tooth, and (d) the caniniform tooth was implanted in a fragment of bone identical in texture, density, preservation, etc., with bone undoubtedly associated with the cheek teeth and unlike other random bone fragments in the vicinity. These facts seem to me to establish a very strong probability that the "dinosaur" tooth belongs to the mammal represented by the cheek teeth.

Even without adding the *a priori* improbability of these being dinosaur teeth to these considerations; as would be logically permissible, it is clear that the weight of evidence is very definitely opposed to the identification of these caniniform teeth as those of dinosaurs. The only reasonable theory is that they do not represent dinosaurs. With the further analysis of other evidence previously given, the whole theory of the association of ungulates and other mammals of Tertiary type with dinosaurs in Patagonia falls down, together with all the elaborate hypotheses invented to explain it or reared on it as a foundation.

In the *Notostylops* beds and also in the *Astraponotus* beds we found other teeth quite as dinosaur-like as M. N. H. N. No. 10871 and nearly as much so as No. 10872. Without exception these can definitely be shown by direct comparison, by association, or by microscopic structure to be either of crocodiles, sparassodonts, or ungulates.

At the present time there is no evidence for the association of dinosaurs and ungulates in Patagonia. Ungulates (and the other apparently exclusively Cenozoic groups) cannot have appeared suddenly and without antecedents. In the late Mesozoic they were somewhere, but there is no evidence at all that it was in Patagonia rather than any other part of the world. Nor is it wholly unlikely that some dinosaurs straggled on into the Cenozoic somewhere, but here again there is a total lack of evidence, especially in Patagonia where they have not yet been surely shown to have survived to the end of the Senonian.[1]

A NEW PATAGONIAN FOSSIL MAMMAL

The curious cheek teeth found with and probably associated with the caniniform, more or less dinosaur-like tooth discussed above are of so much interest in connection with the subject of this paper that they may well be named and briefly described at this time.

[1]In view of the argument as to whether dinosaurs survived longest in South America, it is a curious but probably accidental aspect of the evidence at hand that indubitable dinosaurs are actually known at a later period in North America than in South America.

FLORENTINOAMEGHINIA,[1] new genus

TYPE.—F. *mystica*, new species.

DISTRIBUTION.—*Notostylops* beds, Patagonia.

DIAGNOSIS.—A Patagonian fossil mammal of uncertain affinities. Upper molariform teeth with subequal, well separated paracone and metacone. Protocone and hypocone about equal, partly connate (more anteriorly) to well separate. Proto- and metaconules almost as large as proto- and hypocones and tending to form cross crests with the latter and the para- and metacones. Metaconule partly connate with hypocone and not at all with protocone. No mesostyles. Anterior and posterior, but no internal, cingula.

Florentinoameghinia mystica, new species

TYPE.—Amer. Mus. No. 28402. Three somewhat imperfect upper cheek teeth, with associated skull fragments. Probably associated also with Amer. Mus. No. 28401, caniniform tooth.

HORIZON AND LOCALITY.—*Notostylops* Beds,[2] Oficina del Diablo, Cañadón Vaca, near Paso Niemann of the Río Chico del Chubut, Chubut Territory, Argentina.

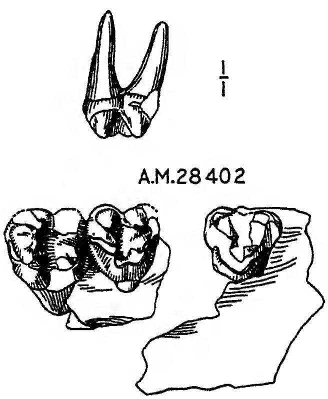


Fig. 7.—*Florentinoameghinia mystica*, new genus and species. Amer. Mus. No. 28402. Two fragments of the right upper jaw with three teeth, crown views, and external view of most complete tooth, M^1?.

DIAGNOSIS.—Sole known species of the genus. ?M^1 measures 10 mm. in both dimensions.

The remains surely belonging to this individual were scattered through about a cubic decimeter of matrix, which also contained the caniniform tooth mentioned above. In addition to several skull fragments showing little distinctive character and without certain mutual contacts, it was possible to piece together two sections of the right maxilla, one containing two teeth, the other one. These two fragments do not indubitably contact, but were apparently contiguous either immediately or with one intermediate tooth.

The most anterior of the three preserved teeth was preceded by a diastema. Nearly five millimeters of the dental border are preserved, and there is no alveolus. The tooth is triangular and nearly equidimensional, about 10 mm. long and wide. The protocone is of the common crescentic type, and there is no hypocone. The metacone is subconical, crested antero- and posteroexternally. The paracone is broken away, but from its emplacement was about equal to the metacone. The protoconule is of moderate size and imperfectly separated from the protocone. The metaconule is not preserved, and may have been smaller. This tooth is probably either P^3 or P^4.

[1] It is simple justice that Ameghino's series of nomenclatural curiosities, *Asmithwoodwardia, Henricosbornia, Guilielmofloweria, Edvardotrouessartia,* and the like, for mammals of this age should terminate with one dedicated to himself.

[2] More exact stratigraphic data will be given in a later paper.

The first of the two teeth preserved in contact is perhaps M^1, for it is molariform but with protocone and metacone more connate than in the following tooth and is more worn than the latter. Its dimensions are those of the triangular tooth just described, but the form is different, more trapeziform. The nearly equal paracone and metacone are the highest cusps, well separated by a deep notch, subconical, and somewhat compressed transversely. The equal protocone and hypocone have connate bases. Nearly as large as these are the protoconule and metaconule, wedged between them and the paracone and metacone respectively, and tending thus to form transverse lophs. There are external, anterior, and posterior cingula of moderate development, without distinct cusps or styles and not extending onto the inner face. There is no mesostyle; on the contrary, there is here a sharp notch in the outer border. The middle of the crown is occupied by a basin, closed all around.

The following tooth, perhaps M^2, is imperfectly preserved but reveals its chief characters. It is larger than that preceding it and more quadrate, the inner side about as long as the outer. The external cingulum was probably weaker, and, as before, there is no internal cingulum, but anterior and posterior cingula are somewhat wider and almost basined. The protocone and hypocone are here well separated, and the cusps tend to form two parallel transverse lophs, each composed of three nearly equal cusps with connate bases.

Above the last two teeth described (but not the first) there are large sinuses, separated by a very thin partition. Those may be the crypts of successional teeth, especially as the bone does not seem fully mature, but the probabilities are somewhat against this as they are not quite of the expected character and the teeth in use are little worn and otherwise without definite suggestion of being milk teeth.

There was a foramen of considerable size internal to a point between the two cheek teeth preserved together, piercing the palate obliquely upward and backward. The other fragments include part of the brain case and an adjoining large sinus, the bone pierced by several foramina and canals but the surface nearly flat, as if from the skull roof. Neither this nor the other parts preserved can be exactly placed.

Of this animal just enough is preserved to show that it is new and very strange, just too little to give a firm basis for conjecture as to its affinities. There is nothing in the Ameghino collection that can be closely compared, and even the probable addition of the strange sabre-like canine hardly adds to its isolation.

It is obviously not a notoungulate, having not one of the characters so clearly distinguishing upper cheek teeth of that group, whether primitive or advanced and regardless of the divergent specializations of the anterior dentition. The large hypocones, tendency to form transverse lophs, and absence of oblique shear make affinity with the carnivorous marsupials extremely improbable, and resemblance to other South American marsupials is even more remote. The only comparisons that appear to be suggestive, and even these not more than suggestive, are with the Litopterna and Pyrotheria. Aside from numerous other distinctions, even those primitive litopterns most nearly comparable retain the

trigon as an entity, with the hypocone added on and distinct, while here the trigon is wholly effaced and the metaconule is not at all related to the protocone but only to the metacone and hypocone. The difference is fundamental, yet a relationship is conceivable. The incomplete most posterior tooth of the three does suggest the most primitive true pyrothere, *Carolozittelia*, the structure of which would be almost duplicated by slight further development of the lophs and merging of cusp individuality. But this and other comparisons do not warrant even a hypothesis of relationship.

REFERENCES

AMEGHINO, F. 1885. Nuevos restos de mamíferos fósiles oligocenos recogidos por el profesor Pedro Scalabrini y pertenecientes al museo provincial de la ciudad de Paraná. Bol. Acad., Nac. Ci. Córdoba, VIII, pp. 5–207.

1897. Mammifères crétacés de l'Argentine. (Deuxième contribution à la connaissance de la faune mammalogique des couches à Pyrotherium). Bol. Inst. Geog. Arg., XVIII, pp. 406–429, 431–521. [Also issued as a separate, pp. 1–117.]

1903. L'Age des formations sédimentaires de Patagonie. An. Soc. Ci. Arg., L and LIV. [Also as a separate, pp. 1–231—this edition used in preparing the present paper.]

1906. Les formations sédimentaires du Crétacé supérieur et du Tertiaire de Patagonie avec un parallèle entre leurs faunes mammalogiques et celles de l'ancien continent. An. Mus. Nac. Buenos Aires (Ser. 3ª, VIII), pp. 1–568.

DOERING, A. 1882. Expedición al Río Negro. III, Geología.

FERUGLIO, E. 1931. Nuevas observaciones geológicas en la Patagonia Central. Direc. Gen. Yac. Petrol. Fisc., Cont. 1ª Reun. Nac. Geog., No. IV, pp. 1–24.

HUENE, F. VON. 1929. Los saurisquios y ornitisquios del Cretáceo Argentino. An. Mus. La Plata, (2) III, pp. 1–196.

LYDEKKER, R. 1895. Supplemental observations on the extinct ungulates of Argentina. An. Mus. La Plata, III, Part II, No. 1.

MORENO, F., AND A. MERCERAT. 1890–91. Catálogo de los pájaros fósiles de la República Argentina conservados en el Museo de La Plata. An. Mus. La Plata, Paleont. Arg., I, pp. 7–71.

PIÁTNITZKY, A. 1931. Observaciones estratigráficas sobre las tobas con mamíferos del Terciario inferior en el Valle del Río Chico (Chubut). Bol. Inf. Petrol., VIII, No. 85, pp. 1–16.

ROTH, S. 1898. Apuntes sobre la geología y la paleontología de los territorios del Río Negro y Neuquén. Reconocimiento de la región andina de la Rep. Arg., Mus. La Plata, pp. 3–56.

1899. Aviso preliminar sobre mamíferos mesozóicos encontrados en Patagonia. Rev. Mus. La Plata, IX, pp. 381–388. [Also as a separate, pp. 1–18].

1900. Some remarks on the latest publications of Florentino Ameghino. Amer. Jour. Sci., (4) IX, pp. 261–266.

1908. Beitrag zur Gliederung der Sedimentablagerungen in Patagonien und der Pampasregion. N. Jarhb. Min. Geol. Pal., Beil. Bd. XXVI, pp. 92–150.

AMERICAN MUSEUM NOVITATES

Published by
THE AMERICAN MUSEUM OF NATURAL HISTORY
New York City

Number 567 Sept. 21, 1932

56.9, 31 U: 14.31, 4 (1181)

ENAMEL ON THE TEETH OF AN EOCENE EDENTATE[1]

BY GEORGE GAYLORD SIMPSON

Edentates owe their rather inappropriate name to the occasional absence and constant degeneracy of the teeth. An outstanding indication of this degeneracy is the absence or very feeble development of enamel in all recent and most ancient forms.

As early as 1874 Tomes announced the discovery of an enamel organ in the embryonic nine-banded armadillo, but he maintained that at least a rudimentary enamel organ is universal in tooth germs and independent of possible later development of enamel. The observation of an enamel organ was several times repeated, but nothing suggestive of actual enamel was reported until Röse's paper of 1892. He stated that enamel was absent as such, but that there arose from the columnar ameloblasts a thin structureless layer lying directly on the dentine and apparently corresponding to Nasmyth's membrane. On the other hand, a paper by Ballowitz in the same year positively denied that enamel could be found at any time in the nine-banded armadillo, and considered the presence or absence of Nasmyth's membrane as indeterminate.

In 1904, however, Spurgin described embryos of this armadillo in which a thin layer of true enamel was present on the deciduous teeth. This was deposited later than the dentine, and precludes the possibility that Nasmyth's membrane could lie directly against the latter. He suggested that the layer seen by Röse might have been very thin enamel. This enamel presumably disappears as soon as the milk teeth come into use, and as yet no enamel seems to have been found on permanent teeth in recent members of this order.

These observations are valid evidence of the fact, so probable or certain from other phylogenetic considerations, that edentate teeth are degenerate and that the ancestral forms did have typical enamel-covered crowns. Theoretical interest centers very largely on the relative rate and time of loss of this tissue in the teeth. Opinions have varied from the view that it is one of the latest specializations, to belief that it is almost as ancient as the mammalian structure itself—for Ameghino, Thomas (at one time, later retracted) and some others have held that the simple edentate tooth structure is not degenerate but primitive and

[1]Publications of the Scarritt Patagonian Expedition, No. 6.

that the edentates are of separate ancestry from most or all other mammals.

As in all historical problems, conclusive evidence must be palæontological. Ameghino and Flower held that enamel did occur in some Miocene to Pleistocene fossil edentates, but these observations were disproven, chiefly by Burmeister and Scott. Until the present note, there seems to have been no record of enamel in functioning or permanent teeth of any xenarthran recent or fossil.

The North American Tæniodonta (Ganodonta of Wortman) have thick enamel of characteristic histologic structure and were formerly considered to be ancestral or related to the Xenarthra, but this view has been abandoned. The late Paleocene to Middle Eocene Palæanodonta of North America are clearly related to the Xenarthra, although subordinally distinct, and they have what is clearly enamel on the canines, although no thin sections have been made. The known cheek teeth show no definite enamel, but this may have been removed by wear. The known palæanodonts branched off from the pre-Xenarthra before the differentiation of the xenarthrans or even before their origin as such.

Direct investigation of the South American edentates has been very much retarded by the imperfect knowledge of any forms older than the Santa Cruz, Miocene. Particularly the edentates of the oldest fauna, the *Notostylops* fauna, all armadillos, so far as known, were represented only by scattered scutes and a few isolated bones that told almost nothing as to the actual structure of the group in the Eocene. The whole subject is now placed on a new basis by the discovery of a specimen, Amer. Mus. No. 28668, which includes both sides of the lower jaw, much of the skull, many endoskeletal elements, several groups of articulated scutes and many isolated scutes. It was found by C. S. Williams in the *Notostylops* Beds, fifty or sixty feet below the main fossil level of this locality, in the great barranca south of Lago Colhué-Huapí, Chubut Territory, Argentina. Ameghino's classification of the Eocene armadillos was based on isolated or doubtfully associated scutes. The various scutes of this one individual represent at least six of Ameghino's "species" and three of his "genera." From these and other possible synonyms, almost all published at the same time, I select the name *Utaetus buccatus* and apply it to our own specimen. It is as old as any applicable name and by Ameghino himself was more widely used than any other. The specimen appears to be a young adult, nearly full-grown but with epiphyses still open.

The specimen as a whole will be described later, the present note being confined to a brief description of the dentition.

The most striking feature is the presence of true enamel on the permanent teeth. This has been examined microscopically in thin sections, leaving no question as to its identification. It is thin, but typical of the simplest types of mammalian enamel. In the limited material

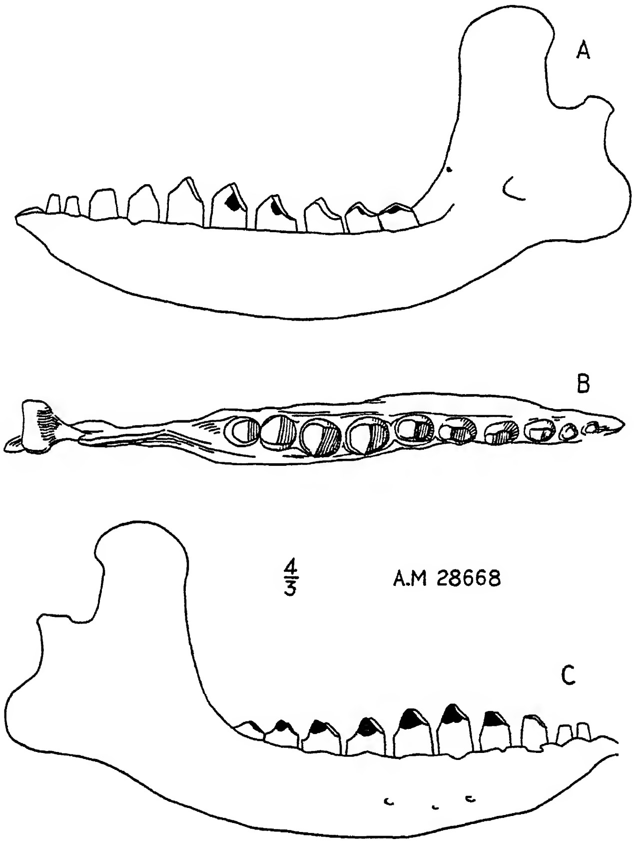


Fig. 1.—*Utaetus buccatus* Ameghino. Left lower jaw, Amer. Mus. No. 28668. A, Internal view. B, Superior view. C, External view. Enamel areas shown in black. Four-thirds natural size.

available for microscopic study, the enamel prisms appear to be straight, parallel, and simple, without any striking or unusual characters.

In the lower jaw there are ten teeth, occupying a space of 37.5 mm. The anterior, edentulous part of the ramus is unusually short, only 2.5 mm. The first two teeth are small and about equal. The third is ab-

ruptly larger and they then increase slightly in size to the seventh and eighth, then the ninth and tenth decrease somewhat. They are all simple and oval to nearly circular in section, and all trace of cusp structure has been removed by wear. The eighth and ninth teeth are nearly circular and the others more or less compressed laterally. All the teeth are deep, without closed roots, and clearly belong to the permanent dentition.

The distribution of enamel is clearly shown in the figures. None of the teeth has anterior or posterior enamel, doubtless because the wear facets here extend below the base of the true crown. Enamel is absent on the first three teeth, present on the outer and not on the inner side of the fourth and fifth, present on both sides of the sixth and seventh, the outer side only of the eighth, and both sides of the ninth and tenth but on very small areas.

Considering size, form, enamel distribution, etc., it is tempting to see vestiges of tooth differentiation into I_2 C_1 P_4 M_3, but these indications may be secondary, and inference should not be pushed so far.

Utaetus is revealed as a true armadillo, primitive in the presence of enamel and in some other respects, but certainly a member of the Dasypodoidea and too advanced to be ancestral to glyptodonts or to ground sloths. Enamel being present on permanent and functioning teeth of this genus, it follows that it must have been present in the common ancestry of these three groups. It has therefore been lost independently at least three times in the evolution of the Xenarthra. This discovery also shows that the loss of enamel was one of the last outstanding specializations of the armadillos and was later than the acquisition of their typical tooth form and most of their other essential characters.

REFERENCES

BALLOWITZ, E. 1892. Das Schmelzorgan der Edentaten, seine Ausbildung im Embryo und die Persistenz seines Keimrandes bei dem erwachsenen Thier. Archiv mikr. Anat., XL, p. 133.

MARTIN, B. E. 1916. Tooth development in *Dasypus novemcinctus*. Journ. Morph., XXVII, pp. 647–681.

RÖSE, C. 1892. Beitrage zur Zahnentwickelung der Edentaten. Anat. Anz., VII, pp. 495–512.

SPURGIN, A. M. 1904. Enamel in the teeth of an embryo edentate (*Dasypus novemcinctus* Linn.). Amer. Journ. Anat., III, pp. 75–84.

TOMES, C. S. 1874. On the existence of an enamel organ in the armadillo. Quart. Journ. Micr. Sci., 1874, p. 48.

TOMES, C. S., H. W. MARETT TIMS, AND C. BOWDLER HENRY. 1923. A manual of dental anatomy human and comparative. Eighth edition, London (pp. 422–427).

AMERICAN MUSEUM NOVITATES

Number 568 | Published by The American Museum of Natural History New York City | Sept. 22, 1932

56 31, 2 (1181: 729.1)

GALLOWAYINA BROWNI, A NEW GENUS AND SPECIES OF ORBITOID FROM CUBA, WITH NOTES ON THE AMERICAN OCCURRENCE OF *OMPHALOCYCLUS MACROPORA*

By Brooks Fleming Ellis

Materials from the Upper Eocene beds on the Anaya River one kilometer below Baños, Santa Clara Province, Cuba, have yielded a number of new forms of orbitoids, and the first specimens of *Omphalocyclus macropora* reported from the western hemisphere. One of the new forms is sufficiently different that a new genus has been erected to receive it. This genus has been named *Gallowayina* in honor of Dr. J. J. Galloway, American authority on Foraminifera, and the species for Mr. Barnum Brown, Curator of Fossil Reptiles in the American Museum of Natural History, who collected the materials.

Gallowayina, new genus

Type:—The genoholotype is *Gallowayina browni*, new species.

Type Description:—Test asymmetrically biconvex, one side being conical and the other nearly flat; surface of the type species rough but not papillate; microspheric nucleoconch probably planispiral, megaspheric one quadrilocular, the small spherical initial chamber partly surrounded by a kidney-shaped second chamber and the two flanked on either side by a hemispherical one, and the four surrounded by a thick fibrous wall; median chambers arcuate, arranged as on the surface of a depressed dome, increasing in size toward the periphery and at the same time rotating, so that, at the edge of the test, they are parallel to and more or less merge with the lateral chambers on the flat side of the test, while standing at a high angle to those on the other side of the median zone; lateral chambers low, thick-walled, perforate, irregular in size and many layers deep on either side of the median layer; pillars numerous on the flat side of the test, often very heavy, but lacking on the conical side, except for a massive plug of shell material extending from the nucleoconch to the apex of the cone. Diameter up to 9 mm., thickness up to 4 mm., with an average diameter of 5–6 mm.

Upper Eocene of Cuba.

Since only one species is known, it is somewhat difficult to determine just which characters are generic and which specific. However much one may question the importance of other characters, the fact that the structure of the nucleoconch is of generic significance is denied by no one; and because of its very distinctive character in this form, it would be neces-

sary to erect a new genus even if the test were symmetrical and the structure of both sides identical. However, the asymmetry is a striking character, manifesting itself not only in the external form of the test but in the internal structure as well, only the nucleoconch escaping its influence. One of the striking features of the internal arrangement is the large number of pillars on the flat side and, with the exception of the apical plug, their complete absence from the conical one; another is the flattening and rotating of the median chambers so that they merge with the laterals of the flat side, near the edge of the test; while the most peculiar feature of all is the doming of the median zone. All or none of these characters may be of generic significance, but the character of the nucleoconch clearly indicates that a new genus must be erected to receive this species.

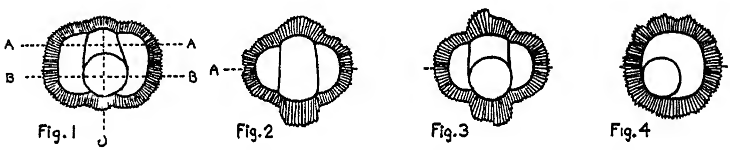


Figure 1.—A horizontal section of the nucleoconch of *Gallowayina browni*, showing the four chambers. The dotted lines show the locations of the vertical sections in figures 2, 3 and 4.

Figure 2.—A vertical section passing through the two hemispherical chambers and the kidney-shaped second one but missing the initial chamber.

Figure 3.—A vertical section, parallel to AA but passing through the initial chamber.

Figure 4.—A vertical section passing through the initial chamber and the kidney-shaped second one.

The significance of the asymmetry is problematic. One explanation is that the animal lived with the conical side of the test embedded in the mud of the bottom. The character of this side seems to support this view, as the absence of pillars and the very small size of the lateral chambers seem to indicate a degenerate condition. Under conditions such as these the warping of the median zone might be explained as an attempt to keep clear of the mud. Another explanation is that the animal lived on a rather firm bottom, with the flat side down, the shape of the test being such as to insure its upright position. Under this hypothesis the restriction of pillars to the flat side might be explained as an attempt to distribute the weight of the test so that the lower side would be the heavier. The apical plug might be the apex of this conical distribu-

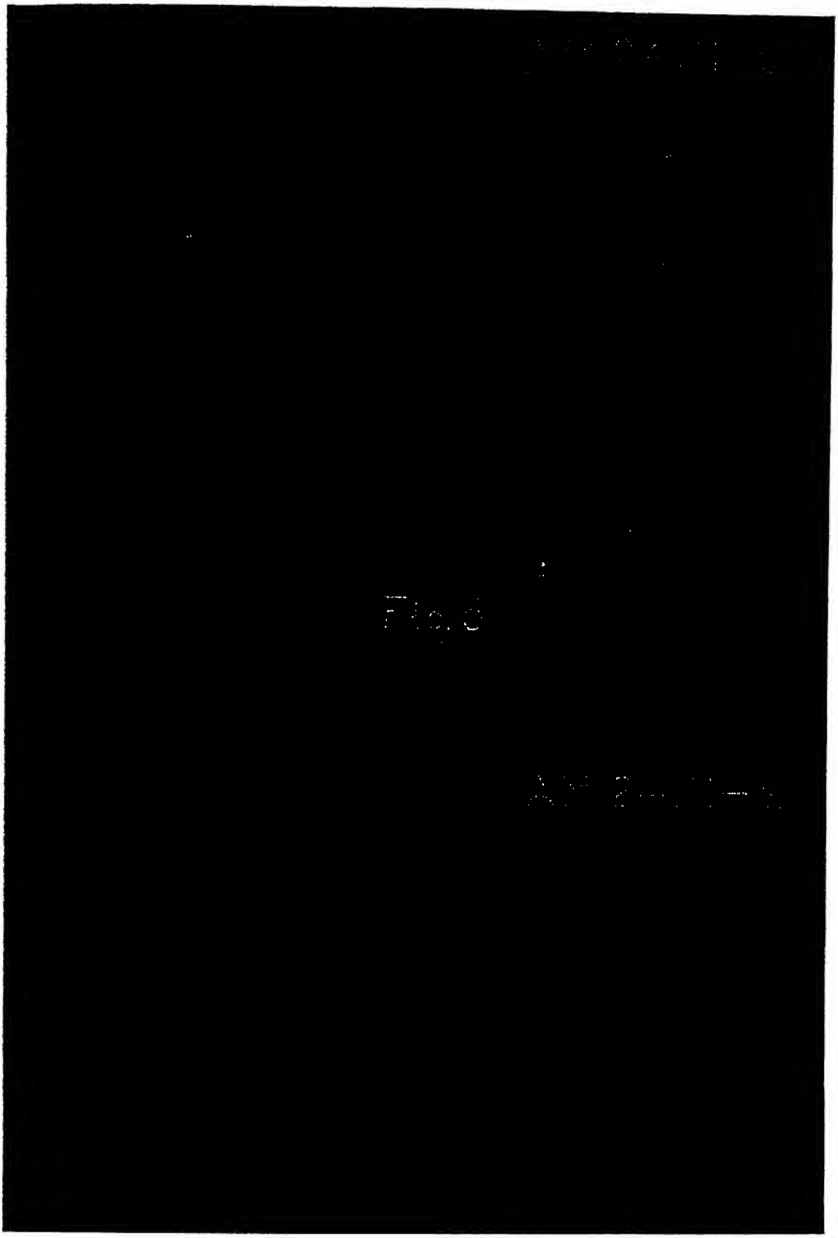


Figure 5.—External view of *Gallowayina browni*, new genus, new species. ×15. American Museum No. 24,111-*b*.

Figure 6.—Vertical section of *Gallowayina browni*, new genus, new species. ×15.. American Museum No. 24,111-*a*.

tion of weight, or the vestige of a pillared condition on the upper side. The fact that it is sometimes absent seems to favor the latter hypothesis.

Gallowayina browni, new species

Type:—The holotype is the horizontal section on slide No. 24,111. The vertical section on the same slide is a paratype.

Type Figure.—Figure 7.

Type Locality and Level:—Upper Eocene orbitoid series immediately overlying the Cretaceous, on the Anaya River, 1 kilometer below Baños, Cuba.

Type Description:—In vertical section the nucleoconch may present various appearances, accordng to the orientation of the section, but in reality it is quadrilocular, the group of four chambers being surrounded by a heavy fibrous wall, with the fibers normal to the surface. The nucleoconch measures 300μ by 500μ, and its wall is about 50μ in thickness. The median zone increases in height from the nucleoconch to the periphery, being about 100μ in height near the center of the test and 350μ near the edge. The chambers of this zone have a normal position near the center of the test but farther out begin to swing about in such a manner that, by the time the periphery is reached, they are parallel to and merge with the lateral chambers on the flat side of the test and stand at a high angle to those above the median zone. At the same time the mediam zone as a whole has curved sharply toward the flat side of the shell until at the periphery it has reached it. The lateral chambers are long, low and very thick-walled, the layers completely filling the dome formed by the warped median zone on one side of the test and adding to the height of the cone on the other. Numerous heavy pillars traverse the layers of median chambers on the flat side of the shell, but, except for an apical plug, are absent from the conical one.

In horizontal section the nucleoconch appears quadrilocular, the small initial chamber being followed by a larger kidney-shaped one and the two bounded on either side by a hemispherical chamber This arrangement gives an ellipsoidal nucleoconch. The median chambers are arcuate to rhombic, increasing in length and width toward the periphery. The laterals are very irregular in outline and the walls are pierced by coarse pores.

The microspheric nucleoconch is apparently planispiral.

This form appears to be the American analogue of *Clypeorbis mamillata* (Schlumberger). It differs from the European form in many important respects, however. The megaspheric nucleoconch of *Clypeorbis* is a trochoid spire, while that of *Gallowayina* is quadrilocular. Then, too, the American form is more conical than the European genus, and there is marked difference in the form and arrangement of the median chambers. Also the median zone of the Cuban form is more dome-like than that of *Clypeorbis.*

Omphalocyclus Bronn, 1853

Type Reference:—Bronn, H. G., Lethaea Geognostica, ed. 3, Vol. II, Part 5, 1853, p. 95.

Type:—(monotypic) *Orbulites macropora* Lamarck. Lamarck, M. le chevalier de, Hist. Anim. sans Vert., Vol. 2, 1816, p. 197.

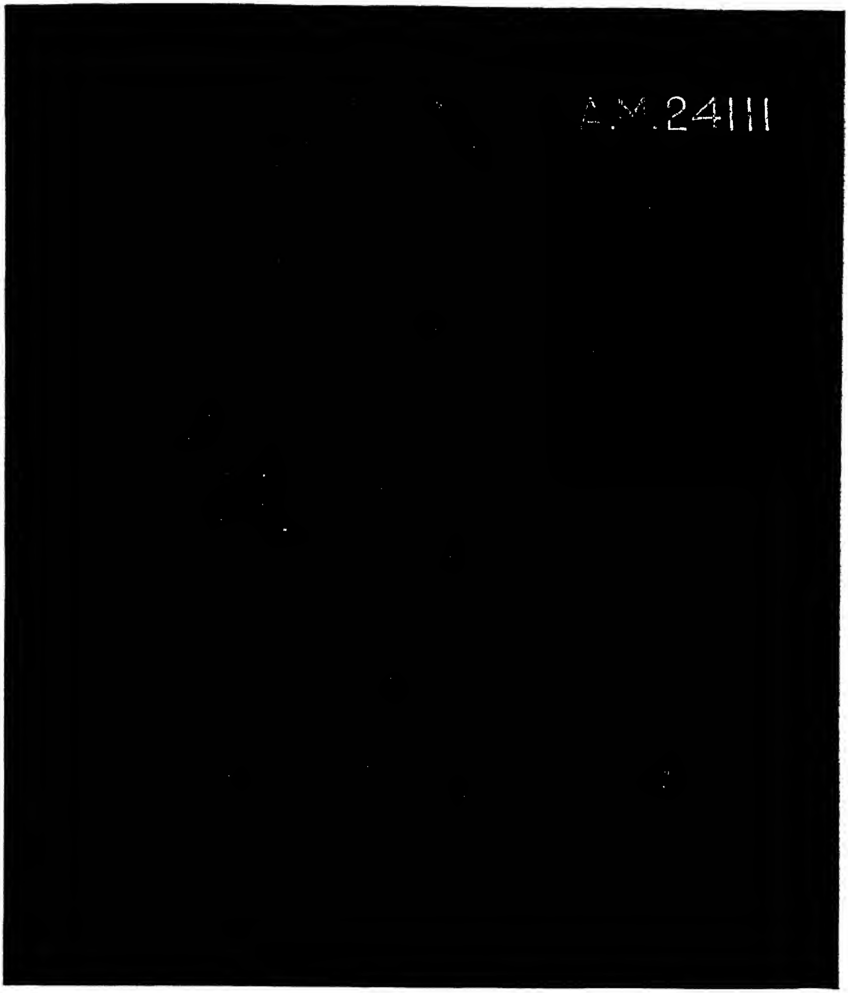


Figure 7.—Horizontal section of *Gallowayina browni*, new genus, new species. ×15. American Museum No. 24,111.

Type Description:—"Schaale kalkig, frei, kreisrund, beiderseits gleich und vertieft; bestehend aus einer mitteln Scheidenwand, welche im Innern zellig und auf beiden Seiten mit bogenförmigen Radial-Rippen in sich kreutzender Richtung (wie Elfenbein) durchzogen ist, zwischen denen rautenförmige Lücken-Zellen übrig bleiben, von welchen die auf den Seiten mit einer Kalkhaut überzogen oder inkrustirt und nur die in der Nähe des Randes gelegenen offen sind. Die Zellchen der nach dem Umfang hin sich verdickenden Mittelwand bilden viele konzentrische Kreise um einander und

nächst dem Rande auch in mehren Schichten auf einander; sie scheinen durch Kanäle mit den oberflachlichen Zellen in Verbindung zu stehen. Gehort wohl schon zu den Bryozoen bei *Lunulites*."

This form is discoidal, thin in the middle and thickening toward the edge, consisting, in the central portion, of a single layer of chambers which soon bifurcate to form two, and between which a little farther out a third layer is intercalated. The chambers of the median layer are arranged in annulæ and those of the lateral layers in intersecting curves. Each chamber communicates by means of a pore with each of the two preceding and the two succeeding chambers, and with the chambers adjoining it laterally. The microspheric nucleoconch consists of a planispiral coil, the megaspheric one of four subequal chambers surrounded by a thick wall. The walls are calcareous, the lateral ones of each chamber being conspicuously perforate, while the walls between chambers are fibrous and imperforate. The walls between the chambers are raised and thickened at the surface. The apertures consist of round pores in three or five rows on the periphery of the test. The diameter ranges from 2 to 12 mm.

Omphalocyclus macropora (Lamarck), 1816

Figures 8 and 9

TYPE REFERENCE:—Lamarck, M. le chevalier de, Hist. Anim. sans Vert., Vol. 2, 1816, p. 197.

TYPE:—None.

TYPE FIGURE:—None.

TYPE LOCALITY AND LEVEL:—Upper Cretaceous, Maestrichtian, Maestricht, Holland.

TYPE DESCRIPTION:—"*Orbulite macropore, Orbulites macropora.* O. complanata, centro depressa; poris utroque latere majusculis. Habite . . . fossile de . . . Mon cabinet.

That this form occurs in America is shown by the presence of specimens in material from the orbitoid series, immediately overlying the Cretaceous, on the Anaya River, 1 kilometer below Baños, Cuba. Horizontal and vertical sections have been made and deposited in the American Museum of Natural History. They bear the specimen numbers 24,-114 and 24,114-a respectively. These individuals represent the only occurrence of this genus and species in the western hemisphere, recorded to date.

Externally the specimens show little beyond the general form, which is discoidal, thin in the middle and thickening toward the periphery. The surface ornamentation, consisting of intersecting arcs of rhombs, is not in evidence in these specimens, due to the fact that they have been strongly eroded. This pattern, which represents the

Figure 8.—Vertical section of *Omphalocyclus macropora* (Lamarck) ×25. American Museum No 24,114-*a*

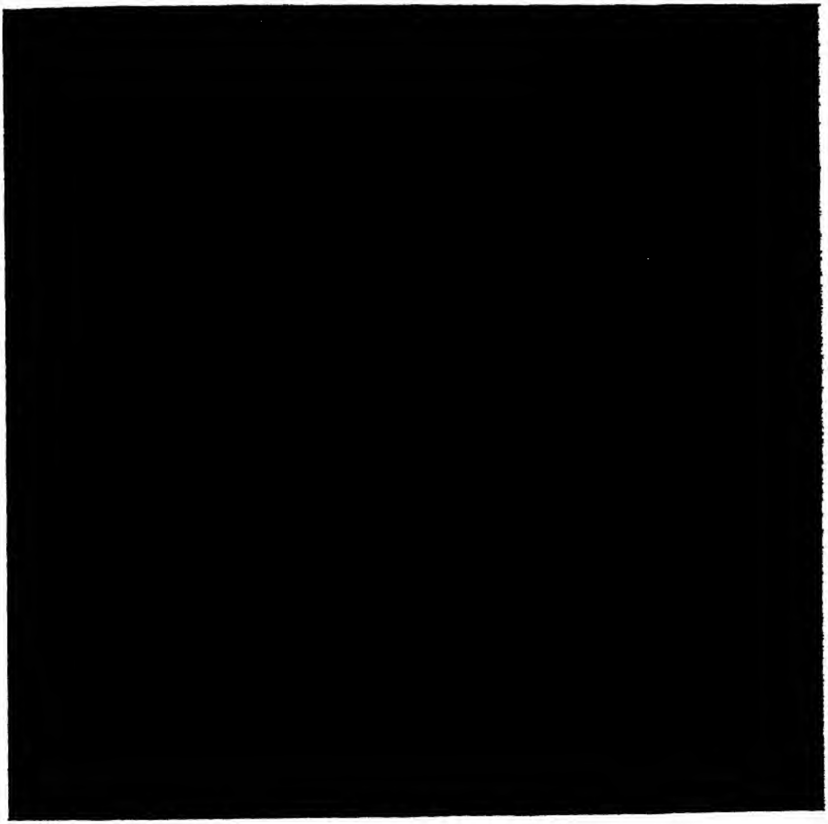


Figure 9.—Horizontal section of *Omphalocyclus macropora* (Lamarck). ×30. American Museum No. 24,114.

elevated edges of the lateral chambers, was apparent, however, on the removal of the outer wall. The three layers of chambers are clearly indicated at the periphery. The diameter is 4 mm., with a thickness of 1 mm. Both specimens are of the megaspheric form.

In vertical section the general arrangement of the layers is shown. In the central portion there is a single layer which bifurcates a short distance from the nucleoconch. Between these two zones thus formed is interposed a third or median zone of chambers. The individual chambers of both the lateral and median zones are rather irregular, but most of them show flattening on the peripheral border. The general form of the cavities is much altered by the presence of secondary deposits.

In horizontal section the four subequal chambers of the megaspheric nucleoconch are very well displayed. They are surrounded by a heavy fibrous wall which in turn is succeeded by the annulæ of the median zone. The median chambers are of the flattened open arcuate type, often rather irregular. As seen in this section the walls consist of three layers, an inner, thin dark layer flanked on either side by thick porous layers which are light in color. There is an aperture at either end of each chamber which connects it with the preceding and succeeding chambers of the same annulus, and also with the chambers of the preceding and succeeding annulæ. The chambers in adjacent annulæ alternate in position.

Level:—Upper Eocene of Cuba. *Omphalocyclus macropora* is known only from the Maestrichtian, but in the Cuban locality it is associated with Upper Eocene forms. The Upper Eocene rests directly on the Cretaceous in this locality.

Locality:—The orbitoid series, immediately overlying the Cretaceous, on the Anaya River, 1 kilometer below Baños, Cuba.

AMERICAN MUSEUM NOVITATES

Number 569 | Published by The American Museum of Natural History New York City | Sept. 22, 1932

59 57,72 D (7/8)

NEW NORTH AND SOUTH AMERICAN DOLICHOPIDÆ, WITH NOTES ON PREVIOUSLY DESCRIBED SPECIES

By M. C. Van Duzee

In working over undetermined dolichopids which had accumulated in the American Museum I found the apparently new species described here. Some of them are very unusual, especially *Sympycnus* (*Calyxochætus*) *insolitus*, new species, which is not typical of the subgenus.

Among the interesting species determined that previously had been described, five are mentioned in this paper, the male of one being described for the first time.

Two mistakes appear in the names of *Chrysotus*, American Museum Novitates Number 483, published August 7, 1931. On page 16 in the table of species, couplets 2 and 4, "*Chrysotus caudatus*, new species," which is preoccupied, should read "*Chrysotus caudatulus*, new species." On page 16 in the explanation of figures, figure 21, "*Chrysotus caudatus*, new species," should read "*Chrysotus caudatulus*, new species," and figures 22, 23, and 24, "*Chrysotus tumidus*, new species," should read "*Chrysotus tuberculatus*, new species." On page 20, for "*Chrysotus caudatus*, new species," read "*Chrysotus caudatulus*, new species."

Unless otherwise stated the types of the new species are deposited in The American Museum of Natural History.

Condylostylus melampus Loew

There are before me five males and four females that I have determined as *melampus*. Three of the males and the four females were taken at Glenwood Springs and Riple, Colorado, the other two males at Highrolls, New Mexico. The only point not mentioned by Dr. Loew is the row of very small, more or less clavate hairs on the upper surface of the middle tibiæ. The males would run to *C. barbatulus* Becker, in M. l'Abbé O. Parent's key to the North and South American species of *Condylostylus* (Ann. Soc. Scient. Bruxelles, XLIX, p. 83, couplet 25). *C. melampus* differs from *C. barbatulus* in having the hypopygium (Fig. 1) moderately large, in my opinion, and the lamellæ are not at all triangular. Dr. Becker says "hypopygium small"; "outer lamellæ triangular at tip." The fore tibiæ in *barbatulus* have "three or four bristles

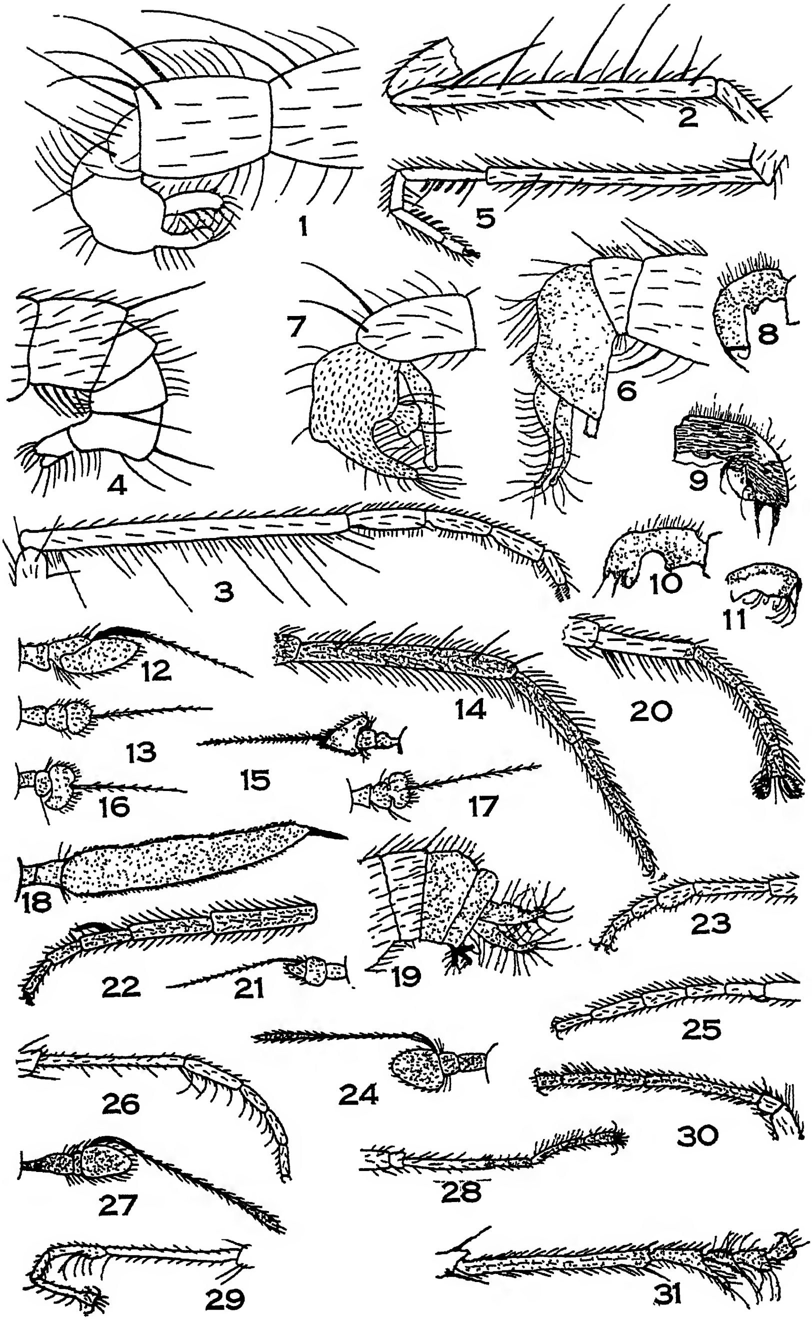

1
2
5
7
6
8
4
9
3
10
11
12
14
20
13
15
17
16
18
23
22
21
19
25
26
24
30
27
28
29
31

Fig. 1. *Condylostylus melampus* Loew. Hypopygium of male.
" 2. " *melampus* Loew. Anterior tibia of male.
" 3. " *melampus* Loew. Anterior tarsus of male.
" 4. " *coloradensis*, new species. Hypopygium of male.
" 5. " *tarsatus*, new species. Anterior tarsi of male.
" 6. " *varitibia*, new species. Hypopygium of male.
" 7. *Sciapus dubiosus*, new species. Hypopygium of male.
" 8. *Mesorhaga flavipes*, new species. Hypopygial lamellæ.
" 9. " *varipes* Van Duzee. Hypopygial lamellæ of male.
" 10. " *cærulea* Van Duzee. Hypopygial lamella of male.
" 11. " *caudata* Van Duzee. Hypopygial lamella of male.
" 12. *Asyndetus flavipalpus*, new species. Antenna of male.
" 13. *Chrysotus longihirtus*, new species. Antenna of male.
" 14. " *longihirtus*, new species. Posterior tarsus of male.
" 15. " *barbipes*, new species. Antenna of male.
" 16. " *bellulus*, new species. Antenna of male.
" 17. " *badius*, new species. Antenna of male.
" 18. *Raphium lugubre* Loew. Antenna of male.
" 19. " *lugubre* Loew. Hypopygium of male.
" 20. *Sympycnus spinitarsus*, new species. Anterior tarsus of male.
" 21. " *minuticornis*, new species. Antenna of male.
" 22. " *minuticornis*, new species. Hind tarsus of male.
" 23. " *brevicauda*, new species. Anterior tarsus of male.
" 24. " *insolitus*, new species. Antenna of male.
" 25. " *insolitus*, new species. Anterior tarsus of male.
" 26. " *insolitus*, new species. Middle tarsus of male.
" 27. " *monticola*, new species. Antenna of male.
" 28. " *monticola*, new species. Anterior tarsus of male.
" 29. " *monticola*, new species. Middle tarsus of male.
" 30. " *furcatus* Van Duzee. Anterior tarsus of male.
" 31. " *furcatus* Van Duzee. Middle tarsus of male.

on outer side of basal half," while in *melampus* the fore tibiæ (Fig. 2) have four long bristles and three a little shorter on the posterior surface, the last of the longer bristles at apical third, the last of the shorter ones at apical sixth, and also a pair near the tip. Dr. Becker describes his species as having distinct, rather pretty, fine cilia on outer edge of upper surface of middle tibiæ, while *melampus* has an indistinct row of slightly clavate hairs on upper edge of posterior surface; but they could scarcely be called cilia and surely not "fine cilia," and might easily be overlooked. The middle tarsi in *melampus* are one and one-half times as long as their tibia and one and one-fourth times in Becker's species. The fore tarsi in *melampus* (Fig. 3) have, on the first segment, three long bristles on apical third, and four a little shorter on apical two-thirds, also from nine to eleven smaller bristles of unequal length placed among the long ones and extending the whole length of the segment. Becker states that the first joint of *barbatulus* has "six or seven long bristles."

It is possible that *barbatulus* Becker will prove to be the same as *melampus* Loew. Both were described from Mexico and Parent reports *barbatulus* from Peru.

Condylostylus coloradensis, new species

Length, 4 mm.

MALE.—Face and front shining green with blue reflections; face with a little white pollen, especially around the edges, wide above, narrower below, its suture at the middle; palpi black with long white hair and black bristles; antennæ wholly black, second segment with the longest bristle below and one and one-third times as long as the antenna; orbital cilia and beard white, moderately long and abundant.

Thorax and abdomen shining green with blue reflections, abdominal sutures rather narrowly black; venter with moderately long white hair; scutellum with two pairs of marginal bristles of nearly equal length; hypopygium (Fig. 4) black, rather small, with short black lamellæ.

Coxæ, tibiæ, and tarsi wholly black, the femora shining green with rather long white hair below; front tibiæ without bristles, except two or three below, which are about as long as the diameter of the tibia; middle femora with two slender bristles near tip on lower posterior surface, their tibiæ on basal half with three small bristles above and two below, longest bristle above near middle and twice as long as diameter of tibia; posterior tibiæ with three small bristles on upper anterior surface of basal half; front tarsi plain, one and one-fourth times as long as tibia, first segment about one-sixth shorter than the tibia; middle tarsi one and one-third times as long as tibia, first segment with six or seven minute spines below, which are a little shorter than diameter of joint; posterior tarsi just equal to their tibia in length and becoming a little more slender toward the tip; segments of front tarsi as 57–13–10–10–7; of middle pair as 79–20–19–11–8; and of posterior ones as 61–24–16–11–8. Calypters and their cilia black; knobs of halteres yellow, petiole dark brown.

Wings grayish with the usual two cross-bands united along the costa back to third vein; the brown on the costa begins just beyond the tip of first vein, extending to tip of third vein, but leaving a narrow gray space along the costa from tip of second vein to tip of third; third vein considerably bent backward at tip; first cross-band of moderate width, extending over the cross-vein to just beyond fifth vein; second cross-band extending over the fork of fourth vein to just back of fourth vein, which ends abruptly a little beyond its fork, from cross-vein to fork as 43, from fork to wing-margin as 22; last section of fifth vein as 17, cross-vein as 28; fork of fourth vein at nearly a right angle to fourth, its upper bend rather broadly rounded; hairs on the costa rather long from the middle of first vein to tip of second, but nearly recumbent, the costa could scarcely be called ciliated.

TYPE.—Described from one male, taken at Wray, Colorado, between August 17–19, 1919, by F. E. Lutz, at an elevation of about 3700 feet.

This specimen seems to come nearest to *C. perspicuus* Becker, but *perspicuus* has three bristles on posterior surface of front tibiæ, and this specimen has none; *perspicuus* was described from Brazil and has the apical half of front tibiæ reddish brown, their front tarsi only a little longer than the tibia, middle tarsi one and one-half times as long as tibiæ, and hind tarsi longer than their tibia. *C. coloradensis* is also something like *C. præstans* Aldrich, from Mexico, but that species has short bristles on second antennal segment; first segment of front tarsi as long as their tibia, last joint a little widened and silvery on one side; its length is 6 mm.

Condylostylus tarsatus, new species

Length, 4 mm.

Male.—Face bare, wide, narrowed a little below, blue-green or blue, rounded below, its suture a little below the middle, when seen from above it is wholly silvery-white pollinose; front shining steel-blue; palpi black, proboscis yellowish; antennæ black, third segment small, rounded, arista dorsal, about as long as width of head; longest bristles on second segment twice as long as the antenna; lower orbital cilia and beard white, rather long.

Thorax bright shining green, front and posterior part and the scutellum usually bright steel-blue, the latter with two pairs of bristles. Abdomen green with blue or coppery reflections; basal half or more of all segments opaque black; venter with rather long white hair; hypopygium black, rather small, with small black lamellæ bearing stiff black hairs on apical part.

Front coxæ and all femora shining green, middle and hind coxæ black; front coxæ with white hair; all femora with long white hair below, which is longest near base; front tibiæ pale yellow, above with two rows of bristles of moderate length on basal two-thirds, and two small bristles below at first and second thirds, apical third without bristles, except the small spurs at tip; middle tibiæ yellow, sometimes with apical half brown, below with one small bristle at middle and a large one at second third, on upper anterior surface with a large bristle at first and second thirds and several bristle-like hairs on basal third; posterior tibiæ and all tarsi wholly black, the posterior tibiæ with one small bristle before basal third on upper anterior edge;

anterior tarsi (Fig. 5) almost twice as long as their tibia, first segment not quite one and one-third times as long as the remaining four taken together, second and fourth segments each with four blunt spines below, the second and third each with two bristles; the apical third of first joint with several long bristles; middle and hind tarsi plain; middle tarsi fully one and one-half times as long as their tibiæ; segments of anterior tarsi as 67–20–9–12–6; of middle pair as 74–21–15–7–5; of posterior pair as 55–22–14–8–6. Calypters and their cilia black; knobs of halteres pale yellow.

Wings nearly hyaline with a brown cloud extending from tip of first vein to tip of second vein and from costa to third vein; costa not ciliated; fork of fourth vein broadly rounded, the fourth ending abruptly a little beyond the fork; last section of fourth vein from cross-vein to fork as 41, from fork to end of fourth as 7, from fork to wing margin as 25; cross-vein as 35, last section of fifth as 20; wing ot about equal width.

Female.—Like the male in color and wing characters, except that all femora are yellow. Anterior tarsi plain, but the first joint has a few bristles below, which are about as long as diameter of segment; segments of anterior tarsi as 58–19–10–7–7; hind tibiæ are wholly black as in the male; longest bristle on second antennal segment about as long as the antenna.

Types.—Described from six males and four females, taken by E. L. Bell, between March 10 to 23, 1931, at Claremont, Jamaica: holotype, male, March 10; allotype, female, March 15.

The form of the anterior tarsi in this species is something like that of the group which includes *C. clavipes* Aldrich, *C. pedestris* Becker, *C. barbitarsis* Parent, *C. rex* Parent, *C. camptopus* Parent, *C. coxalis* Aldrich, *C. brevimanus* Enderlein, and *C. nigrimanus* Van Duzee. It differs from all of these in having the second segment of the anterior tarsi longer than the fourth, and the wings clear, except the small cloud along the costa from the tip of the first vein to the tip of the second.

Condylostylus varitibia, new species

Length about 6 mm.

Male.—Face and front shining blue-green; face with the suture near the middle; palpi and proboscis black. Antennæ black; longest bristle on second segment only a little longer than diameter of the segment; third segment about as long as wide; arista subapical, as long as height of head; beard whitish, not very long or abundant.

Thorax shining metallic green; scutellum with two pairs of long bristles; abdomen largely dull black, most of first segment, lateral corners of second, apical third of second, and wide posterior margins of third and fourth segments bright metallic green; sides at base of abdomen with abundant white hair; venter and sides of apical segment with a few pale hairs; hypopygium (Fig. 6) and its outer lamellæ black, the latter rather long and narrow.

All coxæ, femora, and the hind tibiæ black; front tibiæ yellow, the middle pair blackish on lower and posterior surfaces, yellowish in front and above, but infuscated at the base; anterior coxæ with moderately long but not abundant white hair, and two black bristles at tip; all femora with white hair below, which is about as long as width of femora; all tarsi black; anterior tibiæ with three bristles below; middle

tibiæ with a row of about 65 clavate hairs above, which begin near basal fourth and reach the tip, one moderately small bristle above, near basal eighth, the clavate hairs continued on the first two tarsal segments, the first bearing about 52 and the second ten, those on the second segment are but little enlarged at tip; anterior tarsi plain; hind tarsi with last four segments a very little widened; anterior tibiæ as 105, middle as 158; segments of anterior tarsi as 97–30–20–13–7; of middle pair as 137-33-25-13-6; of hind tarsi as 97–24–20–18–11. Calypters, their cilia and the halteres yellow.

Wings tinged with brownish gray and with the usual two cross-bands rather dark and united along the costa as far back as third vein, and also along fourth vein, the first band reaching hind margin of wing at tip of fifth vein; the second band fills out the tip of the wing to the tip of the fork of fourth vein and reaches beyond base of fork of fourth vein and back of the vein beyond the fork; on the costa the brown begins just before the tip of first vein; fork of fourth vein makes about a 45° angle with basal part of fourth vein; fourth vein from fork to cross-vein as 74, from fork to wing margin as 22; last section of fifth vein nearly straight and reaching the wing margin, its length as 23, cross-vein as 43.

Female.—Wing-bands about as in the male, but the rest of the wing is not tinged with brown; venation the same; arista distinctly dorsal; anterior coxæ and all femora and tibiæ yellow; posterior knees and upper edge of hind femora at tip, for nearly one-fourth their length, are black; all tarsi black; halteres yellow.

Types.—Holotype, male, and allotype, female, taken in the Panama Canal Zone, the allotype at Barro Colorado Island, in November, 1930, by F. H. Schwartz.

In M. l'Abbé O. Parent's table of species of the genus *Condylostylus* (Ann. Soc. Scient. Bruxelles, XLIX) this would run to group IV, couplet 25, on page 10, where it would form a third paragraph, reading "Tibiæ 1 wholly, and tibiæ 2 on anterior surface, yellow." The other species running to couplet 25 are *C. barbatulus* Becker, with the legs wholly black, and *C. triseriatus* Aldrich and *C. leonardi* Van Duzee, both of which have the front and middle tibiæ wholly yellow.

Condylostylus clunalis Coquillett

Sciapus clunalis Coquillett, 1902, Journ. N. Y. Ent. Soc., X, p. 141.

Psilopus nitidicauda Van Duzee, 1929, Proc. U. S. Nat. Mus., LXXIV, Art. 10, p. 12, Pl. I, figs. 21, 22, and 29.

An examination of a paratype of *C. nitidicauda* in my collection shows the inner pair of lamellæ present. The outer pair of lamellæ are nearly glabrous, the inner ones fringed with hair on the edge. In figure 21, in the Proceedings U. S. Nat. Mus., the inner lamellæ are hidden by the outer pair which are a little the larger. In the female the longest bristle on second antennal segment is scarcely as long as the antenna, in the male it is one and one-third times as long as the antenna.

Condylostylus clavatus Van Duzee

Psilopus clavatus Van Duzee, 1929, Proc. U. S. Nat. Mus., LXXIV, Art. 10, p. 15, Pl. I, figs. 24, 25 and 26.

One male and three females that seem to be this species were taken by F. H. Schwartz, in the Panama Canal Zone, during November, 1930: one pair at Corozal and two females on Barro Colorado Island.

The male agrees with the description, except that the lengths of the tarsal segments seem to differ somewhat, the third segment of hind tarsi being distinctly longer than the fourth; the hind femora in this specimen is conspicuously black on upper surface at tip; the wing venation seems to be about the same, having the upper bend of the fork of fourth vein nearly a sharp right angle with a short stump-vein at the bend; the venation of the females is also about the same. In the male the wing cross-bands are faint as in the type, but in the females the bands are very dark brown; the tips of the hind femora are not darkened, or scarcely darkened, in any of the three females.

Possibly these may be a distinct form from *clavatus*, but I do not think so; only a comparison with the type could determine this, and the type is in the Museum of Comparative Zoölogy at Cambridge.

Sciapus dubiosus, new species

Length, 4.5–5 mm.

Male.—Face bare, green, wide above, quite narrow below, suture a little below the middle, wholly opaque with silvery-white pollen when seen from above; front shining blue-green; palpi black with black bristles; proboscis yellow; antennæ wholly black, bristles on second segment no longer, or but little longer, than width of segment; third segment small, about as long as wide, somewhat conical in outline, arista inserted at middle of upper edge, about as long as the eye-height; lateral orbital cilia and the abundant beard white.

Thorax and abdomen green, posterior part of thorax and the scutellum more blue, scutellum with one pair of bristles; abdominal incisures scarcely at all blackened; venter yellowish brown with a few delicate, rather long, white hairs; hypopygium (Fig. 7) black, of moderate size, its lamellæ long and slender, black, fringed on one side with long hairs.

Anterior coxæ wholly yellow, with many rather long, yellow hairs; middle and hind coxæ black with yellow tips; all femora, tibiæ, and basitarsi pale yellow, extreme tips of the basitarsi sharply black, remaining segments of tarsi more or less blackened; all femora with a few quite short, yellow hairs below; middle femora with many bristle-like hairs below on apical third; all tibiæ without noticeable bristles; middle tibiæ and basitarsi with rows of nearly erect hairs, those on the tibiæ not as long, or scarcely as long, as the thickness of the tibia, those on basitarsi fully as long as diameter of segment, these are continued on the following segments, but are not conspicuous; length of anterior tibiæ as 78, of middle pair as 110, and of posterior as

144; segments of front tarsi as 83–27–21–13–8; of middle pair as 97–43–33–20–10; of posterior pair as 85–35–23–14–8. Calypters with white cilia; halteres yellow.

Wings nearly hyaline; costa with long, curved, stout cilia extending from base of wing to beyond tip of second vein; third vein considerably bent backward from before the tip of second vein; fork of fourth vein at nearly a right angle to fourth, its upper bend rounded but quite sharp, beyond this bend the fork is nearly straight, fourth vein beyond the fork rather slender, but nearly reaching the wing margin; last section of fourth vein from the cross-vein to the fork as 40, from fork to wing margin as 23; last section of fifth vein as 15, cross-vein as 43; wing very slightly flattened at tip.

Type.—Described from one male, taken by C. H. Curran, July 11, 1931, at Cold Spring Harbor, Long Island, New York.

The male described above resembles *S. cilicostatus* Van Duzee, from Jamaica, but *dubiosus* has the hind basitarsi pale yellow, with only the extreme tip black; third segment of front tarsi not at all enlarged, fifth not widened, or scarcely widened; middle tibiæ and basitarsi with erect hairs, and cilia of costa a little curved for their whole length and beginning at base of wing, not at the middle of first vein, as in *S. cilicostatus*, which also has these cilia suddenly bent close to their tips, and also has the hind basitarsi almost wholly black, the tip of the third segment of front tarsi enlarged and fifth segment widened.

Mesorhaga flavipes, new species

Length, 2.2 mm.

Male.—Face wide above, about half as wide at oral margin, green, but wholly opaque with white pollen which is tinged with yellow when seen from above; front shining green, blue in the middle, with long yellow hairs on the sides near the vertex, the pollen of the face extending a little above the antennæ; all bristles of the head yellow, but the ocellar bristles appear blackish in certain lights; palpi yellow, nearly round, with white hair on upper surface and a bristle at tip; proboscis yellow; lateral and inferior orbital cilia white, not very long, even below; occiput green with a little white pollen.

Thorax and abdomen shining green with blue or bronze reflections; bristles of thorax and scutellum yellow, but sometimes appearing a little blackish in certain lights; hairs of abdomen decidedly yellow, but when seen from above those on the dorsum appear mostly black, those on the first segment and on lower edge of sides long and white or very pale yellow; hypopygium black, large, extending somewhat under the abdomen, the outer lamellæ (Fig. 8) black with a whitish spine at outer apical corner and a delicate, whitish, curved hair at inner apical corner.

Anterior coxæ green with rather narrow yellow tips, anterior surface with white pollen and long white hair, the hairs at tip more bristle-like; middle and hind coxæ black with white hair and bristles; all femora yellow, but middle ones with a small blackish streak below at base; posterior pair blackish below and on lower part of sides at base, sometimes almost to their middle; all femora with long white hairs below, those on posterior pair shortest and farther apart, those on middle pair long-

est, some being twice as long as width of femora; they begin near basal fourth and reach to apical third, the basal fourth and apical third having only a few short hairs below; the hairs on lower surface of front tibiæ are about half as long as those on middle ones; all tibiæ and basitarsi yellow, extreme tips of basitarsi and the remaining segments brown; hair on all tibiæ mostly yellowish white; tibiæ without bristles and tarsi plain, except that the fifth joints are a very little widened, and first segment of the front tarsi has a row of very fine, delicate, curved hairs on lower posterior surface, which are twice as long as diameter of the segment and are also continued on the front tibiæ but are very easily overlooked; the last four segments of the anterior tarsi have very fine, dense, erect pile on lower surface; front and middle tarsi one and a fourth, hind tarsi one and a fifth times as long as their tibia; segments of anterior tarsi as 45–14–16–6–6; middle pair as 60–19–14–7–5; and posterior pair as 39–33–18–11–7. Calypters yellowish white with long yellow cilia; knobs of halteres pale yellow, the petiole brown.

Wings nearly hyaline; veins black to brown; venation about as usual in the genus; last section of fourth vein from cross-vein to bend as 25, cross-vein as 23 and last section of fifth vein as 30.

FEMALE.—Two females taken with the males have the anterior coxæ wholly yellow, and all femora and tibiæ yellow, tarsi mostly yellow; anterior tibiæ and basitarsi without the long delicate hairs found on the male.

TYPES.—Described from three males and two females, all taken by C. H. Curran, at Cold Spring Harbor, Long Island, N. Y.: holotype, male, and allotype, female, and two paratypes on July 1, 1931, and one paratype June 25, 1931.

M. flavipes is like *M. varipes* Van Duzee (Ent. News, XXVIII, p. 123, 1917, from Massachusetts) in appearance, color of face, antennæ, hair, bristles and front and middle femora, tibiæ and tarsi; both have the same row of delicate hairs on the front tibia and basitarsi, the form of the hypopygium is somewhat similar in both, but the lamellæ of *varipes* (Fig. 9) are larger, more yellow and have several bristle-like hairs that are not found on *flavipes;* in *varipes* the bend in last section of fourth vein is nearly a right angle and the hind femora are wholly black, except the narrow yellow tip; *M. cærulea* Van Duzee has the lamellæ (Fig. 10) even more like this, but has all femora black except base and tips; *M. caudata* Van Duzee also has all femora black, and the genital lamellæ (Fig. 11) are smaller and mostly yellow, with a cluster of curved hairs at inner apical corner and a few small curved hairs on inner surface.

Asyndetus flavipalpus, new species

Length, 2.3 mm.

MALE.—Face green, nearly as wide as the front, slightly longer than wide, a little dulled with white pollen when viewed from in front; palpi rather large, pale yellow, with many yellow hairs; front shining green; proboscis black; antennæ (Fig. 12) black, third segment nearly straight above, evenly rounded below, obtusely pointed at tip; lower orbital cilia long and white.

Thorax and abdomen shining green with blue reflections, last two abdominal segments with bronze reflections; hypopygium concealed; tip of abdomen with four strong bristles.

Anterior coxæ and all femora shining blue-green, the middle and hind coxæ black; front coxæ with black hair and bristles; all femora with about ten black, bristly hairs below; anterior tibiæ yellow, with a row of about ten quite strong bristles on upper posterior edge and a row of ten short bristles or bristly hairs on posterior surface, three or four small bristles on lower posterior edge and long stout hair on lower anterior surface; middle tibiæ yellowish brown, more black at base, with one long bristle above just before basal third, and three or four other small bristles above, also a very small bristle below; hind tibiæ black with small bristles above; anterior tarsi yellow, the apical segments a little blackish, middle tarsi brown, hind tarsi black, conspicuously hairy; anterior tarsi with eight stout hairs above, which are as long as the diameter of segments; anterior and middle tarsi just equal to their tibia in length, hind tarsi a little shorter than their tibia; joints of front tarsi as 19–6–5–5–5; of middle ones as 24–11–8–6–6; of posterior pair as 19–17–12–8–8. Calypters and halteres yellowish white, cilia of former white.

Wings grayish; third vein a very little bent backward at tip; last section of fourth vein thin, bent, not broken; apex of wing about twice as far from tip of third vein as from fourth vein.

Female.—Palpi black; third antennal segment about as long as wide, nearly square, with the corners rounded; front tibiæ with a few small bristles above; no large bristles at tip of abdomen.

Types.—Holotype, male, allotype, female, paratypes, two males, taken by E. L. Bell, June 14, 1930, at Fallon, Nevada, at an elevation of 4000 feet.

This is very much like *A. syntormoides* Wheeler, the general color, proportional lengths of the tibiæ and the tarsal segments and bristles of anterior and posterior legs and feet about the same as in the male of *syntormoides*. The male differs in having the palpi yellow with many bright yellow hairs, and the third antennal segment is evenly rounded below; the female differs in having the third antennal segment nearly square, while in Wheeler's species it is nearly conical in outline; there is also a large bristle near the base of middle tibia of *flavipalpus* that is not found in *syntormoides*.

Asyndetus parvicornis, new species

Length, 2.5 mm.

Male.—Face and front of equal width, their sides straight and parallel, both covered with white pollen; palpi small, black, with black hairs; antennæ black, third segment about as long as wide, somewhat triangular, obtusely pointed at tip; lower orbital cilia and the beard white.

Thorax and abdomen green, dulled with white pollen and with slight bronze reflections, which form indistinct lines on anterior part of thorax; hairs of abdomen black, short; hypopygium concealed, bristles at tip small.

Coxæ and femora green, the hairs yellow; front and middle tibiæ pale yellow; hind tibiæ thickened, blue, a little yellowish above on basal part, with a row of five bristles on upper anterior edge, also a row of erect hairs on upper surface, which are shorter than the bristles; segments of anterior tarsi as 18–8–6–5–6; middle pair as 22–14–12–8–5; posterior pair as 15–13–8–5–7; pulvilli a little enlarged. Calypters and halteres pale yellow, cilia of former white.

Wings nearly hyaline; fourth vein not broken, but apical part very thin, so the connection at the bend can scarcely be traced.

TYPE.—Described from one male, taken June 29, 1920, at Rock Springs, Wyoming, at an elevation of about 6250 feet.

This is nearer *A. currani* Van Duzee, from Panama, than any other North American species. From *currani* it is separated by its very small third antennal segment.

Diaphorus nigripennis, new species

Length, 1.8 mm.

MALE.—Face opaque black, twice as long as wide; eyes contiguous, almost obliterating the front, leaving only a very small, dull black triangle below and above; palpi, proboscis, and antennæ black, the antennæ very small, third segment about as long as wide, somewhat conical with tip flattened, arista almost apical, with long pubescence; orbital cilia wholly black.

Thorax and abdomen dull black, almost velvety, with black hair and bristles; acrostical bristles in an irregular row, small; abdomen with four moderately large bristles at tip; hypopygium mostly concealed, black, the outer lamellæ small, black, with pale hair on the edge; central organ short, slender, pale yellow. Calypters, their cilia, and the halteres, wholly black.

Coxæ black, with black hairs and bristles, tips of anterior pair and their trochanters yellowish; all femora black, anterior pair with a row of black, bristle-like hairs on lower posterior edge, which are not quite as long as width of femora; anterior tibiæ and tarsi yellow, the tarsi scarcely darker at tip; front tibiæ wholly without bristles, but with two rows of hairs below, which are more erect and longer than the others on the tibiæ; front pulvilli large and white, middle pulvilli rather small, white; middle and hind tibiæ and tarsi brownish yellow; middle trochanters with two large bristles, middle tibiæ with one small, slender bristle above at base and two very slender, short ones below, also two larger ones at tip; hind tibiæ with three slender bristles on upper anterior edge and one at tip; length of anterior tibiæ as 39, of middle ones as 45; segments of front tarsi as 20–14–8–5–5; of middle pair as 25–14–19–6–5; both anterior and middle tarsi one and one-third times as long as their tibia.

Wings strongly and uniformly tinged with blackish, only slightly paler black back of fifth vein to the cross-vein and from there back of fourth vein, a little wider near the anal angle; third and fourth veins nearly straight and parallel beyond the cross-vein, the fourth ending in the apex of the wing; first vein reaching four-ninths of the distance to tip of second vein; sections of fifth vein as 35–23, cross-vein as 10.

TYPE.—Described from one male, taken at Puerto Bermudez, Rio Pichis, Peru, July 12–19, 1920.

The form described above is something like *D. opacus* Loew and *D. nigricans* Meigen in color of all parts and in the venation of the wings, except that the wings are darker and more blackish, not brownish; it differs in having the first segment of the front tarsi one-third shorter than the three following segments taken together, and in its very small size; in *nigricans* and *opacus* the first segment of the front tarsi is equal, or very nearly so, to the three following segments taken together. All the specimens that I have determined as *opacus* from western New York and southern Ontario have the wings wholly grayish, not tinged with brown, differing in this point from Loew's description of that species.

Chrysotus longihirtus, new species

Length, 2 mm.

Male.—Eyes contiguous, nearly obliterating the face; palpi thickly covered with white pollen, so as to appear whitish; front shining green; antennæ (Fig. 13) black, third segment small, somewhat rounded at tip with a small notch for the insertion of the arista; lower orbital cilia white.

Thorax shining green with bright bronze reflections; abdomen shining green with black hair; hypopygium and its appendages small, black.

Coxæ, trochanters and hind tibiæ black; femora green; anterior and middle tibiæ yellow; front coxæ with rather long black hair; hind femora with a few long, black, bristly hairs below and four bristles on anterior surface near tip; anterior tibiæ with two bristles on basal half; hind tibiæ and tarsi (Fig. 14) wholly black and rather thick, the tibiæ with four bristles above and a row of long, close-set hairs below; hind basitarsi with long, stiff hairs above, those below a little shorter, remainder of tarsi also very hairy; first segment of front and middle tarsi largely yellow or yellowish brown, last four joints black; length of anterior tibiæ as 34, of hind tibiæ as 55; segments of front tarsi as 16–15–7–5–6; of middle pair as 22–12–9–6–6; of posterior pair as 20–13–9–7–8. Calypters, their cilia and the halteres yellow.

Wings a little grayish; third and fourth veins nearly straight and parallel, fourth vein ending just before the apex of the wing; last section of fifth vein as 34, cross-vein as 8.

Female.—Seven females taken at the same place and at about the same time as the males have the venation the same, the last section of fifth vein being about three times as long as the cross-vein and fourth vein ending slightly before the apex of the wing; color of body and legs the same as in male and third antennal segment nearly the same; the face is wide and silvery white.

Types.—Described from two males and seven females, taken by W. J. Brown, at Natashquan, Quebec, in August, 1929: holotype, male, and the male paratype on the seventh, and the allotype, female, and all female paratypes on the eighth. The holotype and allotype are in the Canadian National Collection, paratypes in The American Museum of Natural History.

This species comes near *C. canadensis* Van Duzee, but differs in having long hair on the posterior legs and feet and the third antennal

segment small. In *canadensis* the third antennal segment is large and the hair on the posterior tibiæ short.

Chrysotus barbipes, new species

Length, 1.7 mm.

MALE.—Eyes contiguous below, leaving a slender green triangle on upper third, which is covered with white pollen when viewed from the proper angle; palpi small, black; front shining green; antennæ (Fig. 15) black, third segment formed about as in *C. obliquus* Loew, except that the upper basal angle extends over the second segment almost to its base; lower orbital cilia white.

Thorax and abdomen shining green, the latter with black hair, except some pale hair on the sides near the base; hypopygium small, mostly concealed.

Coxæ and femora green; anterior coxæ with short pale hairs and black bristles; hind femora with black, bristly hair on posterior surface, which is as long as width of femora; anterior and middle tibiæ and most of their tarsi yellow; hind tibiæ and tarsi wholly black; middle and hind tibiæ and hind basitarsi with long black hair on lower surface; bristles of middle tibiæ strong; segments of front tarsi as 20–10–7–4–4; of posterior pair as 14–12–8–5–4. Calypters yellow with white cilia; knobs of halteres yellow, the petiole brown.

Wings nearly hyaline, veins black; third and fourth veins parallel and straight beyond the cross-vein, fourth ending in front of the apex of the wing; last section of fifth vein slightly arched, its length as 31, cross-vein as 6.

TYPES.—Described from three males, taken by F. E. Lutz, the last of June, 1919, at Electric Lake, Colorado, at an elevation of about 8400 feet.

This species comes near *C. currani* and *C. coloradensis*, all three having the legs colored about the same and the cilia of the calypters whitish; it differs from *coloradensis* in having the third antennal segment larger and the tibiæ and tarsi with much longer hair; from *currani* it differs in having the third antennal segment much larger, that species having the third segment very small; it differs from both in having the upper basal angle of the third antennal segment extending back over the second about to the tip of the first segment.

Chrysotus bellulus, new species

Length, 2 mm.

MALE.—Face very narrow below, the eyes almost touching on lower half, grayish white pollinose; front shining blue-green; palpi small, black, covered with white pollen; antennæ (Fig. 16) black, somewhat kidney-shaped; lower orbital cilia whitish.

Dorsum of thorax, scutellum, and abdomen blue-green, shining; hairs on dorsum of abdomen black, on sides rusty yellow; hypopygium small, black, its appendages very small

Coxæ, femora, tibiæ, and tarsi black, femora with blue-green reflections; anterior coxæ with black hair and bristles; anterior femora with a row of slender black hairs on lower posterior surface, the last two of these hairs bristle-like; hind femora with a row of about five rather large bristles on lower anterior surface; bristles of middle and

hind tibiæ strong; hind tibiæ with quite dense black hair on anterior surface, which is longer than thickness of tibia, and extends on to the anterior surface of their basitarsi, the whole hind tarsi being very hairy; length of front tibiæ as 32, segments of front tarsi as 16–8–6–4–5; of middle pair as 15–11–7–4–4; of posterior pair as 15–11–7–4–4. Calypters dark yellow with yellowish cilia; knobs of halteres pale yellow, their petiole brownish.

Wings nearly hyaline, veins brown, costa blackish; third and fourth veins straight and parallel beyond the cross-vein, the fourth ending in front of the apex of the wing; fifth vein only a little arched, its last section as 34, cross-vein as 8.

FEMALE.—Third antennal segment not notched at tip; face rather narrow for a female, gray pollinose; front and middle tibiæ brown to yellowish brown; hind tibiæ and tarsi less hairy; general color more bronze-green; knobs of halteres yellow to yellowish brown; fourth vein ending almost in the apex of the wing.

TYPES.—Described from one male and six females, all taken by W. J. Brown, in August, 1929, at Natashquan, Quebec: holotype male, on the first of August, all females on the eighth. Types in Canadian National Collection, paratypes in American Museum of Natural History.

In the key to species in Bulletin Buffalo Society of Natural Sciences, XIII, 1924, p. 9, this species would run to *C. excisus* Aldrich, but it probably comes nearer to *C. idahoensis* Van Duzee, differing from that species in having a notch at tip of third antennal segment and the knobs of the halteres yellow.

Chrysotus badius, new species

Length, 1.5 mm.

MALE.—Face very narrow, eyes nearly touching on lower part, silvery white; palpi moderately large, black with pale hairs and one or two black hairs, which are larger and more bristle-like; antennæ (Fig. 17) black, third segment rounded, with the arista inserted in a slight apical notch; upper third of the orbital cilia black, lower ones white.

Dorsum of thorax shining green, with coppery and bronze reflections; abdomen green, with bronze reflections and black hair, venter black; hypopygium blackish, small, with small lamellæ, which are mostly concealed and are fringed with rather long pale hairs; central organ thick and quite long.

Coxæ black, anterior pair with narrow yellow tips and a few black hairs; femora and front and middle tibiæ yellow, upper edge of anterior and middle femora narrowly brown or blackish on upper edge, especially toward tip; hind femora with apical third black; hind tibiæ yellowish brown with apical half black, the upper part of basal half more yellow; first segment of front and middle tarsi yellow, the remaining segments brownish black; hind tarsi wholly black; hind tibiæ with long black hair on lower posterior surface; first segment of hind tarsi with rather long, dense hair on upper surface and also below; segments of anterior tarsi as 21–10–10–7–5; of posterior pair as 19–14–9–6–6. Calypters yellow with a few small black hairs and a row of very small pale ones back of the black ones (these hairs can scarcely be called cilia, perhaps the longer cilia are broken off); halteres yellow.

Wings grayish hyaline; third and fourth veins nearly straight and parallel beyond the cross-vein; last section of fifth vein as 31, cross-vein as 9.

TYPE.—Described from one male, taken by W. J. Brown, August 7, 1929, at Natashquan, Quebec. Type in Canadian National Collection.

This species is so much like *C. wisconsinensis* Wheeler that I separated it with some doubt, but as it was considerably smaller, the anterior coxæ almost wholly black, the front and middle femora dark above, the hind tibiæ brownish on basal half and the hind tarsi wholly deep black, I thought best to describe it as new. All the specimens of *wisconsinensis* I have seen, over thirty of which I took one day at Lancaster, N. Y., have the front coxæ yellow on the apical third to two-thirds, the hind tibiæ are pale yellow with more or less black at tip, and the hind tarsi have more or less yellow at base; the antennæ are formed about the same in both forms.

Raphium lugubre Loew

Raphium lugubre LOEW, 1861, 'Neue Beitr.,' VIII, p. 49; 1864, 'Mon. N. Amer. Diptera,' part 2, p. 141.

This species was described from a female, and since the male has never been described, so far as I know, I am giving a short description of the male here.

MALE.—In both male and female in the specimens before me, the front is very dark, shining blue, almost black; face very narrow, linear, silvery white; palpi smaller than in the female, black, with a little gray pollen; antennæ (Fig. 18) formed as in the female, but a little longer, being as long as the first two segments of hind tarsi taken together, and six times as long as wide; beard white, long and abundant.

Thorax and abdomen very dark blue-green, shining, sides of abdomen near base with considerable white hair; hypopygium and its appendages (Fig. 19) very small, black.

Anterior legs and tarsi about as in the female; middle femora, tibiæ and basitarsi pale yellow, as in the female; hind legs and tarsi wholly black; middle and hind tibiæ each with a few short bristles; middle tibiæ about as 63, segments of middle tarsi as 34–15–7–6–8; of posterior pair as 32–27–18–11–9. Calypters brownish yellow with white cilia; halteres sordid yellow.

Wings tinged with brown in front, dark gray back of third vein; last section of fourth vein slightly bent near its middle; last section of fifth vein as 42, cross-vein as 18.

The male from which this description is made and one female were taken by E. T. Cresson, Jr., May 2, 1907, at Swarthmore, Pa., and are in the American Museum, New York. I have another female taken May 3, 1910, at Great Piece Meadows, New Jersey. The species was described from Carolina. Dr. Aldrich reports it from Delaware Co., Pa., and Mr. Curran reports two females from the same place.

Sympycnus spinitarsus, new species

Length 4.2 mm.

MALE.—Eyes almost touching in the middle of the face, leaving a very small triangle below and a larger one above; lower triangle white pollinose, upper triangle and the front black; palpi small, yellow; proboscis dark brown; antennæ wholly black; third segment about as long as wide, rounded at tip; arista dorsal, black, nearly bare; lower orbital cilia white with black hairs below the neck; occiput black.

Dorsum of thorax and the scutellum dark green; no acrostical bristles visible; pleura black; scutellum with one pair of large marginal bristles and a pair of hairs outside of these bristles. Abdomen blackish with purple reflections, its hairs black; bristles on sides of first segment black; venter with long yellowish hairs; hypopygium mostly concealed, its lamellæ small, triangular, black.

Coxæ black, anterior pair with yellow tips, with rather long white hair and long, pale yellow bristly hairs at tip; front trochanters yellow; all femora and hind tibiæ and tarsi black; narrow tips of anterior and middle femora, front and middle tibiæ and front basitarsi yellow, extreme tips of middle tibiæ brown, knees of hind legs slightly yellow; front tarsi (Fig. 20) black from the tip of first segment, which bears eight long bristles below, the following segment with long hair, fifth a little widened and with large pulvilli; middle tarsi plain, except that the last segment is slightly widened; middle tibiæ with three bristles on anterior surface of basal third, which are about as long as third segment of middle tarsi; front tibiæ without bristles; hind tibiæ with several strong bristles above and two or three small ones on anterior surface of apical third; length of front tibiæ as 52, middle pair as 78, and hind pair as 97; segments of anterior tarsi as 24–12–10–7–8; of middle pair as 38–18–13–6–7; first two segments of hind tarsi as 30-23. Calypters and halteres yellow, former with pale yellowish cilia.

Wings dark grayish, tinged with brown in front; third vein bent backward at tip; last section of fourth vein less bent than third, therefore approaching third a very little at tip, ending just in front of apex of wing; wings rather abruptly narrowed at base; last section of fifth vein as 24, cross-vein as 18.

Described from one male taken at Matucana, Peru, May 27, 1930.

Among South American species *S. spinitarsus* comes nearest *S. difficilis* Van Duzee, described from Argentina and southern Chile, but that species has all tibiæ black, orbital cilia wholly black, and is smaller, being 2.5 to 3 mm. long.

Sympycnus minuticornis, new species

Length 2.5 mm.

MALE.—Face in type with a large, white pollinose triangle above, on lower half the eyes touch, probably because the head is shrunken; front greenish with thin white pollen; antennæ (Fig. 21) wholly black, third joint smaller than second; lateral and inferior orbital cilia white.

Dorsum of thorax and abdomen green, dulled with white pollen; dorsum of thorax without vittæ; hairs on the dorsum of the abdomen yellowish, on the sides partly black; venter blackish with yellow hair; hypopygium conspicuous, greenish

black, its outer lamellæ black, triangular, fringed with long pale hairs, about one-third as long as height of hypopygium; inner appendages triangular, smooth, about as large as the lamellæ.

All coxæ, femora, and tibiæ yellow; anterior coxæ with white hair and with outer surface blackened; hind femora with long yellow hairs below; anterior tibiæ with two rows of yellow hairs below, which are as long as diameter of tibia, also a row of little black hairs above, of which four near the tip are bristle-like; front tarsi black from tip of first joint, which has a bristle below before its middle; middle tarsi plain, yellow with last segment and tips of the others brown; hind tarsi (Fig. 22) brown, yellow at base, third segment with a long curved spine above near the middle, which is two thirds as long as the segment; fourth segment with a small, erect bristle on the side; front pulvilli a little enlarged; length of anterior tibiæ as 45, segments of anterior tarsi as 14–6–6–4–6, their pulvilli as 4; segments of middle tarsi as 35–15–11–7–7; of posterior pair as 25–20–13–10–7, spine on third segment as 8. Calypters and halteres yellow, cilia of the former white.

Wings grayish; last section of fourth vein a little bent just before its middle; beyond the bend it is nearly parallel with third vein, which is nearly straight; tip of fourth vein in front of apex of wing; last section of fifth vein not quite three times, as long as cross-vein; wings narrowed at base.

Described from one male, taken at Aspen, Colorado, between July 24 and 27, 1919, by F. E. Lutz.

This species is closely related to *S. calcaratus* Van Duzee, but *calcaratus* has long yellow hypopygial lamellæ, while in *minuticornis* the lamellæ are small and black.

Sympycnus longinervis, new species

Length 1.8 mm.

MALE.—Face very narrow, linear, white pollinose; front dull greenish; palpi black; first two antennal segments yellow, the third brown, longer than wide, rounded at tip; orbital cilia white.

Dorsum of thorax dark reddish brown, without pollinose lines, quite shining; lower part of pleura somewhat yellow, the posterior edge yellow; abdomen black above, venter and sides of first to fourth segments yellow; its hairs largely black, but appearing yellow in certain lights; hypopygium black with rather long black lamellæ, which are of nearly equal width, pointed at tip and fringed with a few moderately long hairs, the lamellæ are nearly as long as the height of the hypopygium; penis and its sheath pale yellow, about as long as the lamellæ.

Coxæ, femora and tibiæ pale yellow; anterior coxæ with white hair; middle and hind femora each with a rather long preapical bristle; tarsi mostly brown, plain, except that the anterior tarsi have three or four little bristles below at base and second to fourth segments are a little thick; length of anterior tibiæ as 30, middle ones as 42; segments of anterior tarsi about as 17–7–6–6–5, anterior tarsi one and one-third times as long as their tibia; of middle pair as 21–11–8–6–5, of posterior pair as 13–17–10–8–7. Calypters and halteres pale yellow, the former with a small black spot at tip, their cilia black, but with white hairs among them.

Wings narrowed at base, nearly hyaline; third and fourth veins nearly straight and parallel, fourth ending in apex of wing; cross-vein considerably before the middle of the wing; last section of fifth vein as 27, cross-vein as 8.

Described from one male, taken by C. H. Curran, July 1, 1930, at Cold Spring Harbor, Long Island, N. Y.

This species looks very much like *S. lineatus* Loew and *S. inæqualis* Van Duzee, all three forms being of nearly the same size and color, and having the hypopygial lamellæ of nearly the same form and length; *lineatus* has very distinct pollinose lines on the dorsum of the thorax, the other two have no trace of such lines, the dorsum of the thorax being shining reddish brown in both. This species differs from *inæqualis* in having the cross-vein farther from the wing margin, measured on fifth vein; it also differs from both the other two species in having the hairs on the hypopygial lamellæ only about half as long.

Sympycnus brevicauda, new species

Length 2 mm.

MALE.—Face very narrow, linear, white pollinose; front brown pollinose, dull; antennæ black, small, third segment triangular, but little longer than second, arista plain, rather short with short pubescence; orbital cilia white.

Dorsum of thorax and scutellum brownish and covered with brown pollen, without distinct lines; posterior edge of pleura largely yellow. Abdomen black with venter and lower part of sides of basal half yellow; hypopygium small, black, with small, triangular, blackish lamellæ.

All coxæ yellow with yellow hair on anterior pair; all femora and anterior and middle tibiæ yellow, apical third and hind femora, most of their tibiæ and whole of their tarsi black or brown; anterior tibiæ with one bristle above near basal third and a row of about twelve bristly hairs on lower anterior edge, which are scarcely as long as diameter of tibia; anterior tarsi (Fig. 23) with the last four segments black; middle tarsi almost wholly pale yellow; second segment of anterior tarsi widened below; first segment of middle tarsi with several minute spines below; length of anterior tibiæ as 38, segments of anterior tarsi as 19–8–7–6–5; of middle pair as 36–14–11–8–7; of hind pair as 13–23–12–9–8; middle and hind tarsi plain. Calypters yellow with a black tip and cilia; halteres pale yellow.

Wings grayish, narrowed at base; third and fourth veins parallel beyond the cross-vein, only slightly arched, the fourth ending in the apex of the wing; last section of fifth vein as 30, cross-vein as 11.

FEMALE.—Like the male, except that the face is wider and brown pollinose; anterior tarsi plain with several small bristles below, and the wings not narrowed at base, the anal angle being prominent.

TYPES.—Described from one male and three females, all taken by W. J. Brown, August 7, 1929, at Natashquan, Quebec. Types in Canadian National Collection; paratype in American Museum of Natural History.

This species would run to *caudatus* Van Duzee in the key to the species of *Sympycnus* in the Pan-Pacific Entomologist, VII, p. 38,

couplet 15. It differs from that species by having the hypopygial appendages short and black and the second segment of the anterior tarsi is also widened below, especially on the apical part.

Sympycnus (Calyxochætus) insolitus, new species

Length 3 mm.

MALE.—Face white pollinose, very narrow, linear; front dark blue, almost black; antennæ (Fig. 24) black, first segment shorter than third, third broadly rounded, arista enlarged on apical third, with very short pubescence; lower orbital cilia white.

Thorax metallic brown, a little dulled with brown pollen; posterior margin of pleura yellow to yellowish brown. Abdomen black with very slight green reflections, most of the sides of second segment and part of the sides of third yellow; hairs of abdomen yellowish, bristles near hind margin of segments black; hypopygium reddish, its lamellæ small, yellow.

All coxæ yellow with yellow hair; femora, tibiæ and tarsi yellow; anterior tibiæ with one small bristle above, middle and hind tibiæ each with several bristles above; anterior tarsi (Fig. 25) rather thick, especially the third and fourth segments, its segments of nearly equal length, except fourth, which is considerably longer than third; middle tarsi (Fig. 26) slender, first segment with a large bristle at tip and three others about as long as diameter of the segment placed near basal fourth, middle and apical fourth, second segment with four long, slender, curved hairs below, third segment with three, the fourth with two such hairs, fifth segment with several rather long, slender, curved hairs, which are less conspicuous than those on the other segments; hind tarsi plain. Length of anterior tibiæ as 38, of middle tibiæ as 58; segments of anterior tarsi as 10–9–9–13–9; of middle pair as 35–14–8–8–8; of hind pair as 22–25–15–10–8. Calypters and halteres yellow, cilia of former white.

Wings grayish, of nearly equal width to near the base; third and fourth veins nearly parallel beyond the cross-vein, a little bent backward toward tip, fourth ending in apex of wing; last section of fifth vein as 48, cross-vein as 9.

TYPE.—Described from one male, Aspen, Colorado, July 27–29, 1919 (F. E. Lutz), at an elevation of about 8000 feet.

I have placed this species in the subgenus *Calyxochætus* although the first and second segments of the anterior tarsi are of nearly equal length, because the arista is enlarged at the tip. This is the only species of *Sympycnus* from North America which has the arista of the male enlarged at tip and also has the first segment of the anterior tarsi long. The only other species with these same characters is *Sympycnus grandicornis* Van Duzee, described from southern Chile, which has the antennæ wholly yellow and the arista with three enlargements, the last at its tip.

Sympycnus (Calyxochætus) monticola, new species

Length 3 mm.

MALE.—Face narrow, white pollinose; front dark green, rather dull; antennæ (Fig. 27) black, first segment longer than third, somewhat clavate, with a few hairs

at tip above and below, third segment rounded at tip, about one and one-half times as long as wide, arista with long pubescence, about one-fifth shorter than the anterior tarsi; lower orbital cilia white.

Dorsum of thorax shining blackish brown, sometimes with green reflections, a little dulled with gray pollen, which is more brown on posterior surface; scutellum bluish. Abdomen black or greenish black with yellow hairs and black bristles above on hind margins of the segments; sides of second segment yellowish; hypopygium reddish brown, sometimes almost black, its lamellæ small, triangular, black or dark yellowish brown.

Anterior coxæ and their hairs yellow; middle and hind coxæ more or less brown or black, broadly yellow at tip; femora and tibiæ yellow, tips of hind femora above and apical third to half of hind tibiæ blackish; hind tarsi wholly black; middle tarsi brown toward the tip; anterior tarsi with extreme tip of first and whole of the following segments, except the base blackish; femora with yellow hairs below, which are moderately long and bristle-like on posterior pair toward the tip; middle femora with two black bristles near the tip, their tibiæ with one large bristle on upper anterior surface near basal fifth; anterior and middle tarsi slender; fourth segment of anterior tarsi longer than third, a little arched (Fig. 28) with the hair above longer than the diameter of the segment; first segment about as long as wide; first segment of middle tarsi (Fig. 29) without bristles or spines, but with one long hair at tip below, the second segment enlarged at base below and with a few long, slender, curved hairs, third with minute spines below, fourth with about five slender, curved hairs above and longer than third, fifth segment short and slightly widened; length of anterior tibiæ as 36; segments of anterior tarsi as 4–20–10–13–7; of middle pair as 32–13–8–10–4; of posterior pair as 22–25–14–13–9. Calypters, their cilia and the halteres yellow.

Wings grayish; last section of fourth vein a little bent not far from the cross-vein, its tip just before the apex of the wing; third vein bent backward more than the fourth so as to approach the fourth a little at the tip; last section of fifth vein as 38, cross-vein as 9; wings narrowed towards the base.

Female.—Face wider than in the male; antennæ with the first segment short, third segment about as long as wide, arista plain; legs and feet mostly yellow; segments of anterior tarsi as 19–9–7–5–4; wings wider at base; fourth vein ending in the apex of the wing; abdomen almost wholly blackish or brown.

Types.—Described from four males and four females, taken at Electric Lake, Colorado, the last of June, 1919, by F. E. Lutz, at an elevation of about 8400 feet. Holotype, male, allotype, female.

This form would run to *S. distortus* Van Duzee in the key in Pan-Pacific Entomologist, VII, p. 53, couplet 4, and is very much like that species, differing in the first antennal segment having hairs at tip, which is also longer than in that species, the third segment also longer; arista one-fifth shorter than the anterior tarsi in *distortus*, as long as the anterior tarsi in *monticola;* fourth segment of middle tarsi distinctly longer than third in *monticola* and considerably shorter in *distortus* and with moderately long, slender, curved hairs above in *monticola.*

Sympycnus (Calyxochætus) furcatus Van Duzee

Nothosympycnus furcatus Van Duzee, 1929. Proc. U. S. Nat., Mus., LXXIV, Art. 10, p. 29.

Another male has been sent to me by the American Museum and, as the antennæ were broken off in the type, it will be well to redescribe the head here. Face narrow, yellowish brown on upper part, gray pollinose below; palpi and proboscis black; front dark, but bright steel blue; antennæ black, third segment large, nearly twice as long as wide, rounded at tip, arista plain, but slightly blunt with a short bristle-like tip; lateral and inferior orbital cilia white.

Posterior edge of pleura yellowish; hypopygium with blackish, very small appendages and small yellowish lamellæ; length of anterior tibiæ as 35; anterior tarsi (Fig. 30) with the segments as 3–28–9–14–6; of middle pair, measuring over the projections, about as 46–19–8–7–7, (see Fig. 31); of posterior pair as 20–25–15–10–7. Last section of fifth vein only slightly arched.

The type specimen was taken at El Salto, Antigua, Guatemala; this specimen is from San Jose, Costa Rica, taken in March, 1915.

The antennæ and arista are formed almost as in *S. frontalis* Loew.

AMERICAN MUSEUM NOVITATES

Number 570 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Sept. 23, 1932

59.82 (67)

FOURTEEN NEW BIRDS FROM TROPICAL AFRICA

BY JAMES P. CHAPIN

Among the African birds acquired by The American Museum of Natural History in recent years, there are a number that appear to represent undescribed species and races. Of those included in the present paper, four new forms were discovered by Messrs. J. Sterling Rockefeller and Charles B. G. Murphy during the Tanganyika Expedition of 1928–1929, when they collected so successfully in the highlands of Marungu and the mountains west of the Ruzizi River. Two are based on specimens obtained in the Kasai district by Father R. Callewaert, from whom the American Museum purchased a considerable collection. One was contained in the Cameroon collection of Mr. R. H. Drinkwater, presented to the American Museum by Dr. Leonard C. Sanford. Two more were obtained by the American Museum Congo Expedition (1909–1915), three by the American Museum Ruwenzori-Kivu Expedition (1926–1927), and two by myself during a visit to the Congo River in 1930–1931, financed by the late Mrs. Dwight Arven Jones.

Numida meleagris callewaerti, new subspecies

SUBSPECIFIC CHARACTERS.—Intermediate between *Numida meleagris marchei* Oustalet and *N. m. marungensis* Schalow. Lower neck finely barred with whitish, but also washed in front with brownish or bluish. Outer webs of secondaries more boldly barred with white than in *marchei*, wattles narrower and usually only tipped with red. Horny helmet slightly higher than in *marchei*, but not of the bulbous form that distinguishes *marungensis*.

TYPE.—Adult male; Luluabourg, Kasai district, Belgian Congo; January 15, 1924; collected by Father R. Callewaert; Amer. Mus. Nat. Hist. No. 257753.

DESCRIPTION OF TYPE.—Helmet rising only 9 mm. above top of skull, not pointed, but with a ridge extending forward in the mid-line; no horny "bristles" above nostrils. Wattles narrow, but not quite so pointed or pendent as in *marungensis*, total length along anterior border (in skin) 17 mm. Upper hind-neck with black bristly feathers like those of *marchei*, sides of neck and throat nearly bare. Lower neck finely barred all around with grayish white and blackish, tips of feathers on lower fore-neck more uniform and washed with dull grayish lavender. White spots on back and rump slightly larger than in *marchei*, and distinctly smaller than in *marungensis*. On the outer margins of the secondaries the white barring is nearly as extensive as in

marungensis, and the white stippling so noticeable between the bars in *marchei* is wanting. On the rectrices light stippling between the white spots is present, but less extensive than in *marchei*.

Beak pale bluish with red base, helmet brown, cheeks and eyelids light blue, wattles light blue, bordered with red.

Wing, 275 mm.; tail, 153; culmen from cere, 25; metatarsus, 77.

A series of thirteen adults and three chicks was collected near Luluabourg for the American Museum by Father Callewaert, in whose honor the race is named. The specimens show the usual variation found among guinea-fowls. The wattles are sometimes narrower and more pointed than in the type, and never wholly red as in *marchei*. The helmet is always composed of a thicker layer of horny material than in *marchei*, and the relative amount of barring and of bluish wash on the lower foreneck is by no means fixed. The white bars on the outer edges of the secondaries are always broader than in *marchei*, yet in a few examples there are lines of stippling between the bars.

Hitherto there has been some doubt as to the validity and the distribution of *marchei*. In the Paris Museum, some years ago, I examined two of the male types from Doumé, upper Ogowé River, collected by Marche, as well as a female from Yumba on the lower Ubangi River, collected by Dybowski. These three specimens bore out the distinctions given by Oustalet[1]: general coloration darker than that of *galeata*, with more conspicuous spotting on back; deeper color of the brownish blue area around the lower neck; weak development of the helmet. In July, 1930, Mr. Franklin Edson 3d obtained an adult male of *marchei* at Mistandunga, on the middle Congo River just above Yumbi, which I examined in the flesh. It is clear that the range of *marchei* extends from the savannas of the Gaboon, and probably those of the Lower Congo, eastward at least to the confluence of the Ubangi and the Congo. Only the actual line of meeting between *marchei* and *callewaerti* remains to be fixed. It seems certain that *callewaerti* must occupy the greater part of the Kasai district. A female guinea-fowl from Duque de Braganza, northern Angola, which I saw in the Tring Museum, is very similar to *callewaerti* in the barring of the neck and the pattern of the secondaries. The range of this race may therefore be expected to extend from the upper Lubilash River west to northern Angola.

For comparison I have had in addition three skins of *N. meleagris marungensis* Schalow from Marungu, one from Kita-Kita in the Manyema

[1]1882, Annales Sci. Naturelles, XIII, Art. "No. 2" [=1 bis] (Doumé, Ogowé R., Gaboon).

district, and three from the Ruzizi Valley; also eight skins of *N. meleagris maxima* Neumann from the highlands of Angola.

Glaucidium tephronotum medje, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *G. tephronotum pycrafti* Bates of southern Cameroon, but larger, less brownish on crown and back, more rufous on sides of chest and flanks, black spots on underparts narrower and longer.

TYPE.—Adult male; Medje, northern Ituri forest, Belgian Congo; May 7, 1910; collected by J. P. Chapin; Amer. Mus. Nat. Hist. No. 158029.

DESCRIPTION OF TYPE.—Forehead feathers dark brownish gray with hidden whitish bases, crown, nape, and back dark brownish gray, hind-neck with small, half-concealed whitish markings. Upper surface of wings of a somewhat browner tone than back, the outer greater and middle wing-coverts with a faint external margin of deep rufous brown. Remiges blackish brown, with whitish areas invading the inner webs, and, between these, obscure dusky bars. On the distal half of the primaries the dark bars, as seen from below, alternate with grayish ones, but the tips are of nearly uniform dusky color. Under wing-coverts creamy white, with rather large blackish spots on primary-coverts, and a wash of rufous near the outer margin of the wing. Bristly blackish feathers project on lores and chin, otherwise the facial disc is whitish beneath eye, dark gray near ears, but the feathers with whitish bases. Throat whitish with diffuse spots of blackish brown, middle of breast whitish slightly washed with cinnamon, and with numerous blackish spots of elongate-oval form, about 2.6×8 mm. at their largest. Middle of abdomen whitish, under tail-coverts buffy white, each of the longer feathers with a narrow dusky shaft-spot near its tip. Feathering of feet light rufous, the feathers more whitish basally; upper surface of toes with whitish bristles. Rectrices blackish brown above, more grayish beneath, with a series of more or less oval spots of buffy white on inner webs, numbering six on the outermost rectrices, and four on the median pair. Here the basal marking is concealed by the blackish-brown upper coverts, but the three others form a conspicuous row on the upper surface of the tail.

Iris yellow, rim of eyelids yellowish; bill and cere light green; toes yellow, claws grayish.

Wing, 116 mm.; tail, 84; culmen from cere, 11.5.

In addition to the type the American Museum Congo Expedition obtained another male and a female at Medje, and also a female at Nala, between Medje and Rungu. Their measurements are: wing, 116 (♂), 121 (♀), 116 (♀); tail, 83 (♂), 87 (♀), 82 (♀); culmen from cere, 12.5 (♂), 13 (♀), 13 (♀). They are all adult and the uniformity in coloration is well marked. The female from Medje seems a little whiter on the breast than do the others, and on a few of its outermost upper wing-coverts there are some marginal spots of whitish bordered with rufous. One of these skins I compared with the types of *tephronotum* and *pycrafti* at the British Museum. The wings of two males of *pycrafti* from Bitye, southern Cameroon, measured 103, 109 mm.; their tails, 67, 68; culmen from cere, 10.8, 11.

So far as known, the range of *G. t. medje* is restricted to the north-eastern border of the Upper Congo forest. Doctor Schouteden has shown me an immature example from Buta, Lower Uelle district, which is in the Congo Museum.

Glaucidium tephronotum lukolelæ, new subspecies

Subspecific Characters.—Larger than any other race of the species, crown and back grayer than in *medje* or *pycrafti*, probably closer to *tephronotum* in this respect. Spotting of underparts blackish, not rufous as in *tephronotum*.

Type.—Adult female; Lukolela, middle Congo River; August 5, 1930; collected by J. P. Chapin; Amer. Mus. Nat. Hist. No. 296777.

Description of Type.—Forehead whitish, its anterior feathers gray-tipped, posterior ones with a white spot in the more extensive gray tip. Crown and nape light slaty gray, feathers of hind-neck with half-hidden white patches; back, scapulars, rump, and upper tail-coverts darker slate-gray, without admixture of brown. Remiges brownish black, their inner borders creamy white except near tips, and this whitish color extending inward on the inner webs to form imperfect bars. On the primaries the whitish areas do not approach the tips, but give place there to smaller gray markings which cause a suggestion of barring, best seen on the lower surface. Upper surface of the wing a little more brownish slate than the back, and some of the outer greater and middle coverts with narrow external margins of rufous. Under wing-coverts creamy white, with blackish spots on the primary-coverts. These spots are much larger on the greater lower primary-coverts, and there are a few diffuse touches of pale rufous on the outer margin of the wing there. Bristly blackish feathers spring from lores and chin, elsewhere the feathers of the facial disc are dark gray with white bases. Throat, middle of chest, and abdomen white, sides of chest and flanks rather light rufous. Elsewhere the breast is white, rather well spotted with blackish, the larger markings elongate-oval, about 3×8 mm. Feathering of feet whitish with a wash of pale rufous on outer side; upper surface of toes with whitish bristles. Under tail-coverts whitish, unspotted. Rectrices blackish above, grayer beneath, with rounded whitish areas extending in on their inner webs. On the median pair these form three conspicuous spots on the upper surface of the tail. On the outer rectrices there are four such spots, but the two basal ones are confluent along the inner margin of the feather.

Iris bright chrome yellow, rim of eyelids dull greenish yellow; cere greenish yellow, beak yellowish olive; toes dull light cadmium yellow, claws pale olive at base, shading to black distally.

Wing, 127 mm.; tail, 95; culmen from cere, 14.5.

While direct comparison with the types of *tephronotum* and *pycrafti* has not been feasible, I have, for reference, notes taken in the British Museum some years ago. My conviction that *G. tephronotum* Sharpe is not a South American bird,[1] and that the type came really from West Africa, possibly Upper Guinea, remains unchanged. The species is

[1] Chapin, 1921, 'Auk,' p. 456.

represented in Lower Guinea by at least three races. Comparison at the British Museum showed that there is no important difference between *tephronotum* and *pycrafti* in the color of the under wing-coverts. The other distinctions in coloration, excellently shown in the two colored plates,[1] are undoubtedly subspecific. *G. t. pycrafti* is a much browner bird above than *G. t. tephronotum*, with the rufous less extensive on the underparts, and with large oval black spots there, measuring 5×7 mm. on the flanks. In *tephronotum* the rufous of the flanks extends farther toward the middle of the breast, and instead of oval black spots it has elongated, streak-like markings of rufous, shaded with blackish. Of the barring on the distal portion of the primaries, quite distinct in *pycrafti*, there is scarcely a trace in *tephronotum*.

G. t. lukolelæ is the lightest in color of the races of this owl, especially on the underparts, and likewise has the whitest forehead. It is also the largest race; *G. t. medje* is intermediate in size between *lukolelæ* and *pycrafti*, and more closely resembles the latter in coloration.

It is a surprise to find a form so unlike *pycrafti* living at Lukolela, only 450 miles southeast of Bitye. A single specimen of *lukolelæ* gives no clue as to the extent of its range, but one may suspect that it will be found to extend eastward along the southern margin of the Congo forest. At Avakubi in the central Ituri forest we never noticed this small owl, and I am in doubt whether it occurs at all in the heart of the Upper Congo forest.

Gymnobucco calvus congicus, new subspecies

SUBSPECIFIC CHARACTERS.—Allied to *G. calvus major* Neumann of Cameroon, but generally lighter in color, especially on the throat, and with wings distinctly shorter. In coloration it shows only a slight approach toward *G. calvus vernayi* Boulton, of the Angolan highland.

TYPE.—Adult male; Thysville, Lower Congo district, Belgian Congo; December 23, 1914; collected by J. P. Chapin; Amer. Mus. Nat. Hist. No. 159352.

DESCRIPTION OF TYPE.—Bristly feather-tufts pointing forward on chin and at sides of mandible dull buff, sparse rictal bristles brownish black, and a small tuft of buffy bristle-feathers projecting forward and upward behind each nostril. The blackish skin of forehead, crown, and orbital region is not entirely bare, for fine hairy feathers of dark brown color are distributed over most parts. On the middle of the crown these increase in size, and on the nape they become numerous, lighter brown, and with light buff shaft-streaks. Back and scapulars dull brown (near "bistre"[2]) with narrow shaft-streaks of pale buff; rump and upper tail-coverts of the same brown, but feathers margined distally with light brown, and shaft-streaks less noticeable. Upper

[1] *G. tephronotum*, 'Catalogue Birds British Museum,' II, 1875, Pl. XIII, fig. 2; *G. pycrafti*, Ibis, 1911, Pl. VII.

[2] Color names in quotation marks are from Ridgway (1912).

wing-coverts like the back, but almost unstreaked; innermost secondaries "bistre," but remaining remiges blackish brown, with inner edges becoming pale gray-brown toward the base. Under wing-coverts pale grayish brown. Throat "drab-gray," and whole remaining underparts "buffy brown" with light shaft-streaks. The lower abdomen and under tail-coverts are a little lighter brown than the breast and flanks, and unstreaked. Rectrices uniform "clove brown," becoming a little lighter at tip.

Iris dark brown, skin of face blackish, bill rather light rufous brown, feet dusky brown.

Wing, 93 mm.; tail, 47; culmen, 22; metatarsus, 22.

This race appears to range from the southern Gaboon through the Lower Congo to forested areas in northern Angola. In addition to the type and another adult male from Thysville, the American Museum has two males and a female from Ganda Sundi in the Mayombe forest. The measurements of these five skins may be summarized: wing, 88.5–93 mm.; tail, 45–50; culmen, 20.5–22; metatarsus, 21.3–23.

Other specimens examined in the past, which I believe to be referable to *G. calvus congicus*, are two females from Lundu and Temvo in the Mayombe (Congo Museum), one male from Manyanga, and two without sex from Lutete, Lower Congo (Tring Museum), and two males and a female from near Ndala Tando, northern Angola (Tring Museum).

For the present comparison I am indebted to the Carnegie Museum for the loan of a series of skins of *G. c. major* Neumann[1] (two from Efulen and eleven from Minkalli, Cameroon); and I have also seven skins of *G. c. vernayi* Boulton[2] from Mombolo in the Benguellan highland.

The wing-length in *G. c. calvus* (Lafresnaye) of upper Guinea varies from 86 to 93 mm., according to Professor Neumann, but Lafresnaye's type in the Museum of Comparative Zoölogy has a wing of 95 mm.

The wing of *G. c. major* in southern Cameroon varies from 94 to 105 mm., so that is it definitely longer than in *G. c. congicus*. *G. c. vernayi* has the wing-length 90–97 mm., but is strikingly different in color from any other race of the species, being a grayish-brown bird with throat and striping of back and breast nearly whitish.

G. c. congicus, in my opinion, is more similar to *major* than to *vernayi* in general hue, but of lighter brownish color with throat markedly paler and grayer. The upper throat of *major* is somewhat sootier than the breast. The shorter wings of *congicus* facilitate identification.

Cisticola chubbi marungensis, new subspecies

SUBSPECIFIC CHARACTERS.—Differs from *C. c. chubbi* Sharpe in being lighter colored above, duller and less rufous on crown, with more buffy wash on flanks, and

[1]1920, Journ. f. Orn., p. 80 (Buea, Cameroon).
[2]1931, Annals Carnegie Museum, XXI, p. 44 (Mombolo, 6000 ft.).

dark subterminal bars of rectrices less conspicuous. The wing is of about the same length as in the typical race, but the tail distinctly longer.

TYPE.—Adult male; Ketendwe, 6050 feet, Marungu highland, Belgian Congo; February 23, 1929; collected by J. S. Rockefeller and C. B. G. Murphy; Amer. Mus. Nat. Hist. No. 289577.

DESCRIPTION OF TYPE.—Lores blackish, forehead and crown dull rusty brown ("sayal brown"), shading on the nape into the gray-brown of the back. Ear-coverts light brownish, a little paler than the nape; chin, throat, and middle of abdomen buffy white, sides of chest and flanks light gray-brown, middle of chest whitish with a distinct wash of buff, and lower flanks still more tinged with buff. Tibial feathering light cinnamon. Upper wing-coverts like the back, but greater coverts slightly buffy just along the outer edges; remiges darker, more fuscous, but with lighter brown outer borders, and with buffy inner margins except near tips; under wing-coverts pale cinnamon. Under tail-coverts pale buff; rump a little more buffy than the back; median rectrices a little browner than the back, and slightly dusky near their tips. Remaining rectrices (seen from above) are similar, but with inner webs a little more fuscous, subterminal blackish bands becoming rather diffuse on outer webs, and all tipped with pale buff. Tail graduated, outermost rectrices 32 mm. shorter than the median pair.

Iris reddish brown; bill black, but paler beneath base of mandible; feet (in dried skin) light reddish brown, claws more gray-brown.

Wing, 66 mm.; tail 68; culmen to base 17; metatarsus, 26.5.

Three other specimens were taken at the type locality; a male with wing 67 mm., tail, 71; and two females, wings, 61.5, 62, tails, 67, 66. In these three specimens the dark subterminal markings on the rectrices are still less evident than in the type. While none shows any conspicuous sign of immaturity, this second male may not have been fully adult. The length of the tail is not due to increased tail-length in a dry-season plumage, as all the specimens were taken on February 23, in the rainy half of the year. Nor is *Cisticola chubbi* known to exhibit any seasonal difference in plumage.

Presumably this new race is restricted to the highlands of Marungu above 5000 feet. Three specimens from the mountains west of the Ruzizi Valley, also collected by Messrs. Rockefeller and Murphy, are referable to *C. c. chubbi*, and have tails 63 mm. (♂), 60 (♀), and 57 (♀). The tail in eight males from Ruwenzori and the Kivu district I find to vary from 57 to 65 mm., in six females from the same districts, from 53 to 57.5.

According to Count Gyldenstolpe and Admiral Lynes,[1] specimens from the Kivu district run a little more deeply colored throughout than those of Mt. Elgon and vicinity. We have two specimens from Kakamega,

[1] 1930, Ibis, Cisticola Supplement, p 334

Kenya Colony, and the difference is very slight. Marungu is outside the area from which Admiral Lynes had specimens.

C. chubbi marungensis shows no approach in color to *C. nigriloris* Shelley, of the highlands north of Lake Nyasa, although *nigriloris, chubbi,* and *discolor* form a compact group within the genus *Cisticola,* and perhaps in the future will be regarded as a single species.

Apalis binotata marungensis, new subspecies

SUBSPECIFIC CHARACTERS.—Differs from *A. b. personata* Sharpe in being slightly larger, more grayish black on face and fore-neck, the patch on fore-neck bordered with gray, sides of chest greener, and posterior underparts grayer.

TYPE.—Adult male; Kasangala, 7050 feet, Marungu highland, Belgian Congo; March 4, 1929; collected by J. S. Rockefeller and C. B. G. Murphy; Amer. Mus. Nat. Hist. No. 289593.

DESCRIPTION OF TYPE.—Forehead, lores, cheeks, and throat blackish, this color becoming more grayish on ear-coverts and the fore-neck. Crown brownish black, shading to greenish on the middle of nape, and to gray on temporal region. A grayish white patch at the side of the neck, below and behind the ear-coverts. Back, rump, upper wing-coverts, and upper tail-coverts yellowish green ("warbler green"); remiges dark gray with outer margins yellowish green, and inner edges, especially toward the base, pale gray. Under wing-coverts white, washed with yellow on "axillaries," and with dusky central patches on those near the outer border of the wing. The grayish black area of the fore-neck is outlined faintly with gray; the yellowish green areas ("yellowish citrine") at the sides of this dark patch almost meet across the upper breast. The lower breast is grayish white in the middle, like the abdomen, but becomes grayer laterally, and the outer flank-feathers are tipped with greenish. Tibial feathering rather dark gray, under tail-coverts grayish white. Rectrices all dull green, with outer margins brighter yellowish green.

Iris rufous brown, bill (in dried skin) black with tip and tomia light gray, feet (in dried skin) light rufous brown.

Wing, 57.5 mm.; tail, 52; culmen to base, 14.7; metatarsus, 21.

In addition to the type, Messrs. Rockefeller and Murphy collected another adult male of similar size and color at Sambwe, 6100 feet, an adult female at Pande, 6100 feet, and an immature male at Ketendwe, 6050 feet. The female scarcely differs from the males in color, her wing measures 55 mm., tail, 47.

The known range of this new race is restricted to Marungu, southwest of Lake Tanganyika, at elevations above 6000 feet. *A. b. personata,* on the other hand, is found in the highlands northwest of Lake Tanganyika, and in the Rugege forest southeast of Lake Kivu. It extends northward to Ruwenzori and to the Lendu Plateau, west of Lake Albert. My comparative material includes eleven specimens of *A. b. personata,* and the wing-length of adults of that race varies from 51 to 54 mm., tails, 41.5–48.5 mm.

A. b. binotata Reichenow, of which I have had ten Cameroon specimens for comparison, is still smaller (wing 45–50.5 mm., tail 34–41.5). Its crown is gray, and in the female the white of the side of the neck extends forward in a band to the base of the mandible. Though this small lowland race has not yet been found in the Belgian Congo, it occurs in the Cameroon forest, in northern Angola, in Toro, and at the base of Mt. Elgon.

Apalis pulchra murphyi, new subspecies

Subspecific Characters.—Differs markedly from *A. p. pulchra* Sharpe in being paler throughout, lighter gray above, flanks without any deep rufous coloration, and white areas on outer rectrices more extensive.

Type.—Adult male; Sambwe, 6100 feet, Marungu, Belgian Congo; February 28, 1929; collected by J. S. Rockefeller and C. B. G. Murphy; Amer Mus. Nat. Hist. No. 289597.

Description of Type.—Whole upperparts, from forehead to upper tail-coverts, neutral gray, the same gray extending to the upper wing-coverts and the outer margins of the remiges Otherwise the remiges are dusky gray, with whitish gray inner borders. Under wing-coverts white. Lores dark gray, ear-coverts of same neutral gray as crown. Chin and throat creamy white, washed, especially at sides, with light cinnamon-buff. A dull black band, about 8 mm. wide, extends across the chest. Behind this the underparts are very pale buff, like the sides of the throat, except the middle of lower breast, abdomen, and under tail-coverts, which are nearly white. Tibial feathering gray, with a faint wash of buff. Outermost tail-feather wholly white, the next one white except for gray basal stripes extending half-way out on outer web, and one-third the length on the inner margin. On the third feather the basal third is dark gray, and this color covers the outer web except near the tip, and also runs out in a stripe on the inner web to within 19 mm. of the tip. The fourth feather is dark gray with a white terminal patch 8 mm. long, mainly restricted to the inner web; the median pair is entirely dark gray. Tail graduated, outermost quills 23 mm. shorter than the median pair.

Iris light brown; bill (in skin) black; feet (in skin) grayish black, but browner on toes and claws, and gray-buff on soles.

Wing, 56 mm.; tail, 57; culmen to base, 17; metatarsus, 24.

Besides the male type, two adult females were collected, at Sambwe and at Matafali, both localities in the Marungu highland a little above 6000 feet. There is no sexual difference in color; measurements of the females are: wing, 52, 53; tail 54, 55; culmen to base 16.5, 17; metatarsus 22, 23.

There can be no doubt of the affinity of this race to *Apalis p. pulchra* Sharpe rather than to *Apalis thoracica* (Shaw and Nodder) with its numerous races in southern and eastern Africa. Both the *thoracica* group and *A. flavigularis* Shelley have relatively shorter tails with twelve rectrices; whereas in *pulchra* and *murphyi* there are but ten rectrices.

The ranges of the two races seem rather widely separated. *A. p. pulchra* extends from Nairobi and Mt. Kenia west to the Mau, the Lendu Plateau, and the Cameroon highlands. *A. p. murphyi* is only known from Marungu. The mountains along the eastern Congo border, from the northwest side of Lake Tanganyika north through the Kivu and western Ruanda to Ruwenzori, are occupied by *Apalis ruwenzorii* Jackson. This warbler agrees with *pulchra* in having only ten rectrices, but the tail is relatively short, without white areas, and the chest-band is gray. It does appear to be the geographic representative of the same group.

Alseonax infulatus lualabæ, new subspecies

SUBSPECIFIC CHARACTERS.—Slightly smaller than *A. i. infulatus* (Hartlaub), with upperparts lighter brown, underparts paler, and almost no dark breast-band.

TYPE.—Adult male; Kiyuyu, Lualaba River, Belgian Congo; August 9, 1927; collected by J. P. Chapin; Amer. Mus. Nat. Hist. No. 262807.

DESCRIPTION OF TYPE.—Whole upper surface grayish brown ("hair brown" or just a shade deeper), with very faint dusky shaft-streaks on crown; greater wing-coverts a little darker brown and narrowly edged with rufous brown; all but innermost remiges blackish brown, changing to grayish on inner margins, and the secondaries with lighter brown outer edges; under wing-coverts brownish gray. Lores dusky brown, ear-coverts brown like crown, but faintly streaked with pale gray; chin and throat white. Sides of chest pale grayish brown, middle of chest faintly clouded with pale grayish brown on the whitish color which continues down over the breast, abdomen, and under tail-coverts; flanks lightly washed with brownish; tibial feathering light buffy brown. Rectrices brown like back, slightly darker on distal portion, and with lighter brown outer edgings.

Iris dark brown; bill brownish black, becoming gray at base of mandible; feet blackish.

Wing, 64.5 mm.; tail, 50; exposed culmen, 10.4; culmen to base, 15; metatarsus, 15.

This race of swamp flycatcher was found to be common along the banks of the Lualaba River in the great marshes about Lake Kisale. Neave[1] reported collecting the species on Lake Bangweolo, but whether the form frequenting that lake is *lualabæ* or, as stated in Sclater's 'Systema,' *ruandæ*, I cannot say. It may also be recalled that Reichenow reported a specimen of "*infulatus*" from Langenburg on Lake Nyasa, with upperparts rather light brown.

The three males and two females of *A. i. lualabæ*, which I collected at Kadia, Kiyuyu, and a little north of Kiabo, have the following dimensions: wing, 62–64.5 mm.; tail, 47–50; culmen to base, 14.7–15; metatarsus, 14.5–15. For ten skins of *A. i. infulatus* (Upper Uelle, Lake

[1]1910, Ibis, p. 125.

Albert, Jinja on Lake Victoria, Kakamega), I find the wing 64–69 mm.; tail, 48.5–53.5; culmen to base, 14.5–16; metatarsus, 15–15.5. Between these two races lives the larger *A. i. ruandæ* Gyldenstolpe, of which I have examined eight skins (Lake Bunyoni; near Lake Mutanda; Lake Kivu; Luofu) with measurements as follows: wing, 70–76; tail, 55–61; culmen to base, 15.3–17; metatarsus, 15.5–16.5.

Alseonax aquaticus (Heuglin), which lives in swamps of the Bahr-el-Ghazal and western Sudan, is a much grayer bird and, from the scanty material accessible to me now, I cannot decide whether *infulatus* is conspecific with it or not.

Alseonax lendu, new species

Specific Characters.—Allied to *Alseonax olivascens* (Cassin), but darker brown above, grayer beneath, and with bill distinctly smaller.

Type.—Adult male; Djugu, 5500 feet, on Lendu Plateau in eastern Ituri district, Belgian Congo; August 16, 1926; collected by J. P. Chapin; Amer. Mus. Nat. Hist. No. 262832

Description of Type.—Upperparts from forehead to tail dull dark brown ("clove brown"), rictal bristles well developed (about 9 mm. long), lores dusky, with a narrow but distinct pale gray supraloral line; feathering of eyelids and cheeks dark brown mixed with whitish; ear-coverts more brown, but with pale shafts. Upper surface of wing darker brown than back, but greater coverts and remiges with faint outer edgings of lighter, more ochreous brown; under wing-coverts very pale gray, with dusky centers near outer margin of wing Wing of rather rounded form, with outermost primary 21 5 mm. long, and the fourth from outermost is the longest primary. Chin whitish, throat whitish with broad clouded striping of light gray; chest more uniform brownish gray, lower breast light gray broadly margined with whitish; abdomen grayish white; outer flank feathers brownish gray, becoming darker and browner posteriorly. Tibial feathering grayish brown, becoming whitish gray internally. Under tail-coverts gray-brown with broad whitish margins. Rectrices of same dark brown as remiges, and with outer margins a little lighter brown. Tail very slightly rounded.

Iris Vandyke brown; bill blackish brown, becoming light gray on base of mandible, a little chrome yellow on skin of gape; feet dull bluish gray, claws blackish gray.

Wing, 77 mm.; tail, 59; exposed culmen, 9.5; culmen to base, 14; metatarsus, 18.

No other specimen was secured, the type being taken in mountain forest close to the station of Djugu. *Alseonax olivascens*, to which the present species is best compared, inhabits the lowland forest from the Gaboon and Cameroon east to the Ituri and Semliki. For comparison I have before me an adult male of *olivascens* from Medje, Ituri forest, as well as an adult female and an immature male from the forest of the

Semliki Valley. The whole loral region, in *olivascens*, is uniform gray. In general form, except that of the bill, *A. lendu* is similar to *A. olivascens*. In the latter species the wing measures 67–77.5 mm., tail, 49–62, exposed culmen, 10–12, culmen to base, 14–16, metatarsus, 14–18. I have examined the types of *Parisoma olivascens* Cassin and *Bradornis sylvia* Reichenow. Cassin's type was immature, and *sylvia* is undoubtedly a synonym.

Tchitrea smithii mayombe, new subspecies

Subspecific Characters.—Like *T. s. ignea* Reichenow, but rectrices and outer margins of most of the remiges blue-gray in adult males. Tail less rufous and back darker in females. Differs from *T. s. schubotzi* Reichenow in having the head black when adult, and from *T. s. smithii* (Fraser) in having remiges and rectrices lighter and more bluish.

Type.—Adult male; Ganda Sundi, Mayombe district, Belgian Congo; April 20, 1931; collected by J. P. Chapin; Amer. Mus. Nat. Hist. No. 297026.

Description of Type.—Whole head and throat black, moderately glossed with blue-green, crest short, its longest feathers only 10 mm. Back, rump, upper tail-coverts, and lesser and middle upper wing-coverts rich orange-rufous ("Mars orange"); greater wing-coverts similar on exposed parts, but at base and on the greater area of inner webs they are gray. Breast, flanks, abdomen, and under tail-coverts bright "orange rufous," a little lighter than the back; tibial feathering slightly paler, as are the under wing-coverts. Remiges "blackish mouse gray," with outer webs of all except outermost primaries and a few inner secondaries blue-gray ("deep Payne's gray"). Innermost secondaries rufous, a little duller than the back, and the next two margined with rufous. Upper surfaces of rectrices bluish gray ("deep Payne's gray") with blackish shafts, from below they are darker and duller; tail graduated; median pair of rectrices 8 mm. longer than the next, the outermost rectrices are still in molt.

Iris dark brown, rim of eyelids dull blue; bill dull blue, black along tomia and at very tip; feet rather bright blue.

Wing, 79.5; tail, 87; culmen to base, 19; metatarsus, 15.

The range of this race includes the Belgian Mayombe and the forests along the Middle Congo River at least to Lukolela, and probably to the vicinity of Coquilhatville. At Ganda Sundi I collected two adult males and an immature male, while at Lukolela three adult males and four females were secured. The males from Ganda Sundi are somewhat lighter on the back than those of Lukolela, and one from Lukolela is varied with gray on the scapulars and upper wing-coverts. The females from Lukolela, all apparently adult, are of course much duller than the males, and more brownish or olivaceous on the back, duller and less bright orange-rufous on the breast. The crowns of all are black, but one has a dark gray throat. While the gray coloring of rectrices and remiges is

darker and much less pronounced than in the males, it is sufficiently evident to distinguish them from females of *T. s. ignea* taken in the Ituri forest, and the Ituri females are all more rufous on the back. One adult female from Eala, Equator district, agrees with Lukolela specimens, but unfortunately I have no male from Eala or vicinity.

The immature male from Ganda Sundi is readily identifiable by its bluish gray tail, and the gray edgings of its primaries; but its crown and nape are gray, not black; and the orange-rufous of its chest invades the throat, where the feathers are only lightly tipped with gray. I have taken a young male of *ignea* with gray head in the region of Beni, eastern Congo, so this is not exceptional among young birds.

It is, however, of some importance here, as the closely allied *T. s. schubotzi*, of the Ubangi and eastern Cameroon forest, apparently is gray-headed throughout life. At the Berlin Museum, some years ago, I examined two skins of *schubotzi*, one a male from Bangui, the other, without sex, from Yukaduma. In the Frankfort Museum also I saw a fully adult male from Bangui. That the gray heads of these birds are not an immature character may be taken as proved, especially in view of the tail-length, 105 mm., given in the original description.

The type of *T. s. ignea*, from northern Angola, is preserved in the Berlin Museum, where I compared it with a male from Avakubi, Ituri district. The Ituri bird was a little brighter rufous, especially on the back, but no other difference was noticeable, so the gray-tailed birds of the Middle and Lower Congo are not *ignea*.

Despite the variability one always finds among these paradise flycatchers, it seems justifiable to give a name to this form with a separate range at least 500 miles in extent. While I did not see *T. s. neumanni* Stresemann in the Mayombe forest, it has been recorded from Chinchoxo close to Landana, only 60 miles to the west. I am thoroughly convinced that *smithii, nigriceps, fagani, tricolor, neumanni, mayombe schubotzi, ignea,* and *bedfordi* are all races of a single species. With regard to *rufiventer* and *emini* there is still room for doubt, but further study may prove that *rufiventer* Swainson is the proper specific name, as Doctor Stresemann[1] believes.

Psalidoprocne holomelæna ruwenzori, new subspecies

SUBSPECIFIC CHARACTERS.—Differing from *P. h. holomelæna* (Sundevall) and *P. h. massaica* Neumann by its shorter and less deeply forked tail. Under wing-coverts of about the same shade of brownish gray as in *massaica*.

[1] 1924, Journ. f. Orn., pp. 256–260.

TYPE.—Adult male; Kalongi, 6900 feet, Butahu Valley, West Ruwenzori; December 17, 1926; collected by J. P. Chapin; Amer. Mus. Nat. Hist. No. 262784.

DESCRIPTION OF TYPE.—Entire head, body, and tail black, with a moderate oily gloss of brownish green almost everywhere, most noticeable on crown. The whole upper surface of the wing is like the back, but the remiges, seen from below, are blackish gray, gradually becoming lighter gray toward their inner margins. Under wing-coverts and "axillaries" mouse gray. Outermost primary with the hooklets along its outer edge which are always present in adult males of *Psalidoprocne*.

Iris very dark brown, bill black, feet dusky brown, lighter gray-brown on metatarsi.

Wing 114 mm.; outermost rectrices, 85; depth of fork in tail, 34.5; culmen to base, 9; metatarsus, 9.5.

Four adult males and a female from the western slopes of Ruwenzori, an adult male from the mountains just east of the Rutshuru Plain, and an adult male from the western base of Mount Mikeno, all belong to this race, which appears to range from Ruwenzori south to the Kivu Volcanoes, the shores of Lake Kivu, and probably to the mountains northwest of Lake Tanganyika.[1]

Specimens from this area have been compared with others from South and East Africa by Professor Reichenow[2] and Count Gyldenstolpe,[3] both of whom decided that there was little or no difference in wing-length or color of under wing-coverts. This is true, and it is doubtful whether *massaica* can be separated from *holomelæna*. The wings of three males of *holomelæna* from South Africa measure 107, 110, and 113 mm., while those of eight males of *massaica* from Kenya Colony measure 112–119 mm., and those of six males of *ruwenzori* from the eastern Congo measure 107–114 mm. In wing-length *ruwenzori* does not differ from *holomelæna;* but in the form of the tail, at least in males, it is readily separable from East and South African birds.

Race	Outermost Tail-quill	Depth of Tail-fork
holomelæna, 3 males	82–90 mm.	40–45 mm.
massaica, 8 males	85–99 mm.	39–50 mm.
ruwenzori, 6 males	73–85 mm.	28–34.5 mm.

It may be that females will show some corresponding, if slight, difference in the length of the tail. I have only one female of *ruwenzori*, with outermost tail-feather 66 mm., depth of tail-fork 20 mm. Count Gyldenstolpe gave the tail-length in three females from Ngoma on Lake Kivu as 72, 74, and 77 mm., their wings 102, 103, 105 mm.

[1]See Sassi, 1916, Annalen K. K. Naturhist. Hofmus. Wien, XXX, p. 242.
[2]1911, 'Wiss. Ergebn. Deutschen Zentral-Afr.-Exp. 1907–1908,' III, p. 298.
[3]1924, Kungl. Svenska Vetenskapsakad. Handl., (3) I, No. 3, p. 230.

Zosterops stenocricotus kasaicus, new subspecies

Subspecific Characters.—Most closely allied to *Z. s. pusillus* Reichenow of the forested Cameroon and northern Congo, but without any yellow frontal patch, and yellow of throat and breast duller.

Type.—Adult male; Luluabourg, Kasai district, Belgian Congo; December 5, 1925; collected by Father R. Callewaert; Amer. Mus. Nat. Hist. No. 258612.

Description of Type.—Through the lores runs a faint blackish line, and about the eye a narrow circle of white feathers. Upperparts "warbler green," nearly uniform, but a little more yellowish on upper tail-coverts. Wing-coverts, innermost secondaries, and outer margins of all the other remiges of same green as the back; otherwise the remiges are blackish brown, becoming light gray along their inner margins. Under wing-coverts grayish white, washed with yellow, "axillaries" pale yellow. Ear-coverts yellowish green like crown, but throat and middle of underparts and tibial feathering bright yellow ("pinard yellow"), chest and flanks a little more greenish, nearer "pyrite yellow"; under tail-coverts a little brighter yellow than throat ("strontian yellow"). Rectrices blackish brown distally, a little grayer basally, and with green outer margins which extend nearly the whole length of the median quills, but are less evident distally on the more lateral ones.

Iris yellowish brown, bill black, feet bluish.

Wing, 54; tail, 34; exposed culmen, 9.5; culmen to base, 13; metatarsus, 15.

So far as I am aware this race is restricted to the Kasai district. Though I have not seen the white-eye obtained by Dr. H. Schouteden at Macaco near Luebo, I feel sure that it must agree with the six specimens collected for us by Father Callewaert near Luluabourg. The Philadelphia Academy also has two skins from Luluabourg, which I have examined and measured.

Two of our specimens are plainly immature. The six adults from Luluabourg have wings, 52–54 mm., tails, 33–36, culmen to base, 13–13.5, metatarsus, 14.5–16. In size there is no difference of importance between *kasaicus* and *pusillus*,[1] but the greenish forehead in the former is distinctive. The white-eyes of Angola, referred by Sclater to *anderssoni* Shelley and recently described as *Z. senegalensis quanzæ* by R. M. de Schauensee, are larger birds, with wings 61–64 mm.

Zosterops s. pusillus seems to range from the Ja River in southern Cameroon eastward to the northern edge of the Ituri forest, and we have eight specimens from Medje. They agree closely with one in the U. S. National Museum from Bitye, southern Cameroon. From Buea, Cameroon, the type locality of *stenocricotus*, the Carnegie Museum has kindly lent me three specimens; and in the Berlin Museum I have examined the type of *stenocricotus*, as well as another skin also from Buea.

[1]The wing-length of the type of *pusillus*, according to Grote, is 53 mm.

The wing-length in five specimens from Buea is 51.5–55 mm.; tail-length, 33–35. In size, therefore, *pusillus* is only very slightly smaller than *stenocricotus*. According to Bates the wing-length is 49.5–53 mm. in five specimens of *pusillus* from southern Cameroon.

The difficulty of finding any satisfactory arrangement for the numerous forms of yellow-breasted white-eyes in Africa is all too well known. I have named this new one as a race of *stenocricotus* merely to emphasize its affinities. But I agree with Mr. Bates[2] that *stenocricotus* and its near relatives in West Africa are all closer to *Z. senegalensis* than to *Z. virens*. The wash of green on the flanks varies in such a way that I cannot regard it as a specific character.

Cinnyris rockefelleri, new species

SPECIFIC CHARACTERS.—Allied to *Cinnyris regius* Reichenow, but sides of breast not yellow, and bill much longer.

TYPE.—Adult male; at 9000 feet on Mt. Kandashomwa, west of Ruzizi Valley, eastern Belgian Congo; July 9, 1929; collected by J. Sterling Rockefeller and Charles B. G. Murphy; Amer. Mus. Nat. His. No. 410078.

DESCRIPTION OF TYPE.—Whole head, back, throat, and fore-neck brilliant metallic green, a narrow violet chest-band separating this green from the red of the breast. The breast is scarlet across its entire width, except for the light chrome-yellow pectoral tufts close to the wings. On the upper surface of the wings the lesser and middle coverts are metallic green like the back and scapulars, but the greater coverts are dull brownish black, margined externally with brownish olive (near "citrine"), as are also the primaries and secondaries. Beneath the wing the primary-coverts are blackish edged with dull greenish, secondary-coverts whitish gray with a wash of yellowish, and "axillaries" light gray basally, dull yellowish toward tips. Posterior flank-feathers, abdomen, and tibial feathering dull yellowish olive. Rectrices blackish, with faint blue sheen on the upper surface, tail rounded, with outermost quills 9 mm. shorter than the median. Longer upper tail-coverts metallic violet, with hidden bases blackish; under tail-coverts all orange-vermillion with yellowish and gray at bases.

Iris very dark brown, bill and feet black.

Wing, 55.5 mm. (but outer primaries molting, so that the full length is somewhat greater); tail, 43 mm.; exposed culmen, 24; metatarsus, 19.

A second male of the species secured at the same place on the day following has wing 58 mm., but outer primaries still growing in; tail, 44.5; exposed culmen, 22; metatarsus, 18. No female was collected. At 7650 feet on the same mountain a male of *Cinnyris regius* was taken by Messrs. Rockefeller and Murphy, so that the two forms cannot be regarded as representative races. The difference in length of bill is constant. A series of nine males of *regius* from Ruwenzori and the Kivu district shows the length of exposed culmen varying from 15.5 to 19 mm.

[2]1930, 'Handbook of the Birds of West Africa,' p. 463.

Ploceus (Othyphantes) bannermani, new species

SPECIFIC CHARACTERS.—A yellow-breasted weaver allied to *P. bertrandi* (Shelley), of Nyasaland and southern Tanganyika Territory, but without black on crown or nape.

TYPE.—Adult without indication of sex, but perhaps male; Djang district, 4500 feet, Cameroon; May 7, 1930; collected by R. H. Drinkwater; Amer. Mus. Nat. Hist. No. 295349.

DESCRIPTION OF TYPE.—Forehead and anterior crown "cadmium yellow," shading through "lemon-chrome" on nape to yellowish green on back, rump, and upper tail-coverts. A pure black facial patch includes the lores, a narrow space above the eye, ear-coverts, malar region, chin, and upper throat. From the lower throat to under tail-coverts, rich yellow ("lemon-chrome"); flank-feathers and outer tibial-feathering somewhat washed with green. Wing-coverts fuscous black, so broadly margined with green as to look almost like the back; remiges fuscous black, margined externally with yellowish green and internally with grayish olive. Outermost primary 27 mm. long, exceeding the primary-coverts by 14 mm. Under wing-coverts whitish buff, with a heavy wash of yellow. Tail slightly rounded, outermost rectrices 5 mm. shorter than the median; all rectrices olive-green, with outer edgings more yellowish green.

Iris yellow, bill black, feet dull brownish.

Wing, 77 mm.; tail, 56; culmen to base, 19; metatarsus, 24.

This is the bird mentioned by Bannerman[1] and by Bates[2] as the male of *Ploceus anochlorus* Reichenow.[3] The type of *anochlorus*, however, has been shown conclusively to be a hybrid between *Ploceus* (*Hyphanturgus*) *nigricollis* and *brachypterus*. In 1921 I examined Reichenow's type in the Frankfort Museum, and I agree with the conclusions of Stresemann and Neunzig[4] concerning the hybridization of these two forms.

On June 12, 1909, at Ninong, Manenguba Mts., Cameroon, Captain Boyd Alexander collected two female hybrids such as Stresemann and Neunzig describe. These were identified as *anochlorus*. He also obtained at the same place a black-faced bird which was assumed to be the male of the supposed *anochlorus*, although his original label gave the sex as female. In 1930 Mr. R. H. Drinkwater, in the Nkongsamba district, Cameroon, secured five male hybrids, *nigricollus* × *brachypterus:* and now it is certain that Alexander's black-faced weaver represents a distinct species, which I here name in honor of Mr. David A. Bannerman.

Mr. Drinkwater obtained two additional adult specimens of this new weaver: one sexed as a female, in the Nkongsamba district, May 3, 1930; and one not sexed, in the Djang district, May 7. It may be that

---

[1]1915, Ibis, p. 660.
[2]1930, 'Handbook Birds W. Afr.,' p. 486.
[3]1912, Journ. f. Orn., p. 321 (Yakoma, Uelle River)
[4]1924, Journ. f. Orn., pp. 537–540, and especially p. 583.

two of the three known specimens are wrongly sexed, or that the male and female are almost exactly alike, or else that the male remains to be discovered. The type of *bannermani*, I conclude, may well be a male.

The supposed female from Nkongsamba has the wing, 76 mm.; tail, 54.5; culmen to base, 19; metatarsus, 24. Alexander's female from Ninong has the wing, 77 mm.

AMERICAN MUSEUM NOVITATES

Number 571 — Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City — Sept. 23, 1932

59.57,72 S

NEW STRATIOMYIDÆ IN THE AMERICAN MUSEUM OF NATURAL HISTORY

BY MAURICE T. JAMES

I am indebted to Mr. C. H. Curran for looking over and passing judgment on the type material of all species described here, except *Stratiomys jonesi*.

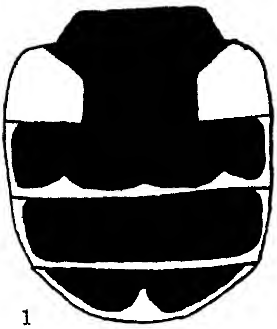
Stratiomys hirsutissima, new species

Figure 3

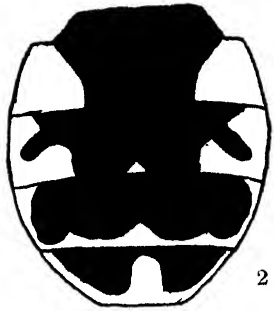
FEMALE.—Length, 13 mm. Face and front wholly black, clothed with pale yellow pile, which is unusually long and dense on the face and around the base of the antennæ; a somew[redacted] longer and denser tuft of pile at the lower posterior corner of each eye[redacted]cipital orbits black above, broadly reddish yellow below; facial orbits ve[redacted]rowly [redacted]w below. Antennæ of the normal *Stratiomys* type, the first seg[redacted] abo[redacted] times the length of the second, the third segment cylindrica[redacted]tire[redacted]ck in color. Thorax black, densely covered with shaggy yellow pile; the[redacted] similarly clothed with pile, except around the coxæ. Scutellum yellow, th[redacted]broadly black. Spines yellow, brownish at the tips. Abdomen broad, flat, largely yellow; the first segment wholly black, except for a pair of lateral triangles; the fifth segment black, except for a narrow yellow margin and a large median triangle; the remaining segments yellow, with the following black markings: a semi-oval spot at the base of the second, only narrowly separated from the apex of the segment in the middle; a transverse band on the basal half of the third, and nearly reaching the lateral margins, its posterior edge triarcuate; a transverse band on the basal half of the fourth, reaching nearly to the lateral margins, and widest near the margins, its posterior edge irregular. First ventral segment black, with a yellowish spot at the base; second yellow, with two irregular black spots on the basal third; third black, with yellow lateral and posterior margins, and a pair of large lateral triangles; fourth and fifth black, with broad yellow lateral and posterior margins. Femora black, reddish yellow at the tips; basal half of tibiæ reddish yellow, apical half black; tarsi yellow, claws black. Wings hyaline, reddish brown; veins distinct, red. Length, 13 mm.

HOLOTYPE.—♀; Alamosa, Colo., altitude, 7500 ft.; June 15, 1919.

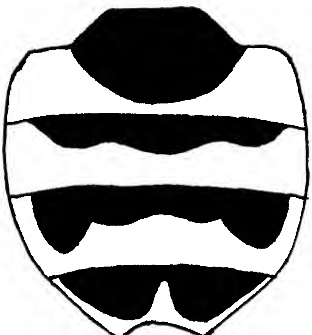
This species seems closest to *S. lativentris* Loew, but can readily be distinguished from that species by the black face, front, and vertex, the narrower occipital orbit, which is black above instead of yellow, the black on the femora and anterior tibiæ, the more extensive yellow



1

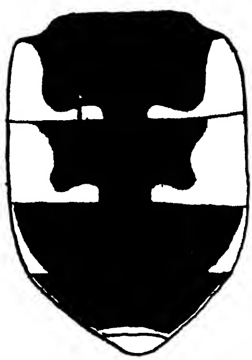


2



3

4



5

Fig. 1. Abdomen of *Stratiomys angulicincta*, n. sp. Female.
Fig. 2. Abdomen of *Stratiomys wyomingensis*, n. sp. Male.
Fig. 3. Abdomen of *Stratiomys hirsutissima*, n. sp. Female.
Fig. 4. Abdomen of *Stratiomys currani*, n. sp. Male.
Fig. 5. Abdomen of *Odontomyia idahoensis*. n. sp. Male.

markings on the abdomen, and the increased pilosity of the head and thorax. The abdomen is much flatter than in most species of *Stratiomys*, and in the type the anal segments are considerably recurved.

Stratiomys angulicincta, new species

Figure 1

FEMALE.—Length, 12.5 mm. Antennæ of the normal *Stratiomys* type, black. Face, front, and vertex black, except for a small, subcordate yellow spot just anterior to the ocellar triangle; pile of face, front, and vertex straw-yellow, densest on the face. Occiput black; occipital orbits black above, yellow below, the black extending about two-fifths the length of the eye; facial orbits yellow, black at the lower corners of the eyes. Thorax wholly black, clothed with straw-yellow pile, which on the dorsum is dense and appressed. Abdomen black, with the following yellow markings: a pair of large subquadrate lateral spots on the second segment, nearly the width of the segment; a posterior margin on the third, which widens into three triangles, one median, and a pair on each side, at some distance from the lateral margins, and almost directly behind the inner angles of the spots on the second segment; a continuous posterior margin on the fourth; an apical margin and median triangle on the fifth; and a narrow lateral margin which completely circumscribes the abdomen, except for the small first segment, which is wholly black. The venter is black, except for the following yellow markings: a broad band on the second segment, continuous at the sides with the subquadrate markings of the dorsum, but narrowing somewhat toward the middle, so that the base of the segment is black; narrow posterior margins on the third, fourth, and fifth segments; a narrow lateral margin on the fourth and fifth segments, a wide one on the third. The abdomen is clothed with very short, inconspicuous, black and yellow pile. Coxæ, trochanters, and femora, except tips, the apical half of the front and middle tibiæ, except extreme tips, and the apical two-thirds of the hind tibiæ, except the extreme tips, black, or reddish black on the trochanters and tibiæ; the remainder of the legs yellow, darkening to brown on the apical tarsal segments. Wings tinged with yellow, the veins reddish.

HOLOTYPE.—♀; Alamosa, Colo.; June 15, 1919.

Close to *S. apicula* Loew, but quite distinct. The form of the posterior margin of the third abdominal segment is perhaps the best distinguishing character.

Stratiomys wyomingensis, new species

Figure 2

MALE.—Length, 11 mm. Head wholly black; face clothed with straw-yellow pile, somewhat receding; antennæ black, of the normal *Stratiomys* type; occipital orbits very narrow above, wider below, black; eyes subcontiguous, glabrous. Thorax shining black, clothed[1] with rather long yellowish pile, which is densest on the sides; pectus concolorous, with shaggy pile; scutellum black, yellow on the apical third; spines yellow, brownish at the tips. Halteres greenish yellow, the

knob brown. First abdominal segment wholly black; the remaining segments black, with the following yellow markings: a pair of lateral subquadrate markings each on the second and third segments, each the width of the respective segment and about twice as broad at the apex as at the base of the segment, the markings of the third segment deeply interrupted by a black extension which nearly attains the lateral margins; a small median triangle also on the third segment; a pair of triangles at the anterior angles, the lateral margins, and the posterior margin, the latter with a median triangle and a subtriangular spot to each side of it, on the fourth; the narrow lateral margins, and a large subtriangular apical spot which nearly attains the base of the segment, on the fifth segment. Venter: first segment wholly black; second and third yellow, with a pair of elongate, triangular, black spots at the base of the second, and an irregular elongate black line, with a biarcuate posterior margin, in the basal half of the third, and bordering the basal incisure; fourth and fifth black, with lateral and posterior yellow margins, broad on the fourth and narrow on the fifth. Coxæ, trochanters, and femora, except tips, black; apical half of tibiæ black to reddish brown, darkest on the front, lightest on the hind, tibiæ; remainder of legs reddish yellow, except apical tarsal segments, which are brown. Wings hyaline; veins reddish yellow.

HOLOTYPE.—♂; Jackson, Wyo., altitude, 6500 ft.; July 13–17, 1920; F. E. Lutz.

Apparently near to *S. quaternaria* Loew. The yellow abdominal markings characterize the species.

Stratiomys jonesi, new species

FEMALE.—Length, 13 mm. Eyes black. Face reddish, clothed with pale yellow pile; somewhat receding. Front black; a small subcordate spot above the base of the antennæ, and the lower occipital and facial orbits, yellow. Antennæ of the normal *Stratiomys* type; reddish brown. Proboscis reddish brown. Thorax black, clothed with short yellowish and blackish pile, the yellow pile giving the effect of two dorsal stripes that extend almost to the suture, and of two others that join these obliquely from the humeri; pile of pectus whitish. Scutellum yellow, except for a narrow black base; spines yellow, tipped with brownish yellow. Abdomen black, with the following yellow markings which are probably variable: a pair of lateral triangles on the second segment; posterior margin of the third, which widens to a triangle medially and to two somewhat broadened stripes at the sides, the margin therefore being biarcuate in its anterior aspect; posterior margin and median triangle on the fourth; a median triangle and posterior margin on the fifth; and lateral margins on all segments but the first. Venter black; the posterior margins of all segments except the first yellow, the margin of the second segment being the widest; all the margins widening into triangles medially; the black of the first and second segments somewhat reddish in hue. Femora reddish brown, yellow at the tip; tibiæ and tarsi reddish yellow, the apical segments of the posterior tarsi reddish brown. Wings opaque, whitish; the strong veins yellow, the weaker ones rather indistinct.

MALE.—Length, 10 to 13 mm. Frontal triangles reddish; eyes reddish, bare, subcontiguous. Pile on face more prominent than in the female. Pile of dorsum

longer than in the female; but the vittate appearance is lacking. Femora darker; hind femora reddish black or reddish brown. Otherwise as in the female.

TYPES.—Holotype: ♀; Brighton, Colo.; July 8, 1915; C. R. Jones. Allotype: ♂; same data. Paratypes: 3♂; same data.

Considerable variation is shown in the abdominal markings of the males. In the allotype, they are as described for the female; in one paratype, they are similar to those of *S. unilimbata* Loew; in the other two, the markings are still more reduced, those of the fourth segment resembling those of *S. normula* Loew.

This species is undoubtedly close to *S. unilimbata* Loew, of which it may be a subspecies. The best characters for distinguishing it are the opaque wings, the reddish-brown antennæ, and the reddish-brown femora. The abdominal markings are too variable to be used as distinguishing features.

Stratiomys currani, new species

Figure 4

FEMALE.—Length, 12.5 to 13 mm. This species is close to *S. melanostoma* Loew and *S. bruneri* Johnson, and like them is characterized by the short first segment of the antennæ and by the keystone-shaped yellow apical marking on the fifth segment; it is considerably smaller than *S. melanostoma*, and can very easily be distinguished from that species by the much greater distance between the yellow markings on each of the second and third abdominal segments, and by the wholly pale venter. It most nearly approaches *S. bruneri*, from which it differs in the following respects: the black band of the vertex is much broader and occupies about two-thirds of the entire region between the base of the antennæ and the occiput; posteriorly, it extends to the occipital angle, except for a very narrow border, this border being interrupted in the middle, where a narrow black stripe connects with the black in the region of the occipital fossa. A narrow black stripe along the mid-frontal suture connects the black of the vertex with the spot at the base of the antennæ; this spot is black, rather than brownish black, as in *S. bruneri*, and emits two very narrow processes which reach almost to the inner margins of the eyes. A considerable region around the oral margin is black. The face is clothed with yellow pile, which is much longer and denser than that of the specimens of *S. bruneri* that I have for comparison, although one female *S. bruneri* from Pagosa Springs, Colorado, approaches this condition. Scutellum wholly yellow, except at the corners; some of the pile black. Abdominal spots on the second, third, and fourth segments separated by approximately one-half the width of the abdomen. Venter a dirty yellow. Femora reddish brown, becoming black just before the apex; the extreme apex yellow; tibiæ, especially the hind ones, darkened to reddish yellow at the apex.

MALE.—Face, occiput, and ocellar triangle black; occipital and facial orbits yellow, much narrower than in the female. Face, as in the female, densely clothed with yellow pile. The abdominal spots of the second and third segments widely

separated, as in the female; those of the fourth segment contiguous. Femora black; tips of femora, tibiæ, and tarsi yellow. Otherwise as in the female.

TYPES.—Holotype: ♀; Electra Lake, Colo., altitude, 8400 ft.; June 28–July 1, 1919. Allotype: ♂; Montpelier, Idaho, altitude, 6100 ft.; July 6, 1920. Paratypes: 1♀; Electra Lake, Colo., altitude, 8400 ft.; June 28–July 1, 1919; 1♂; Paris, Idaho; July 8, 1920; 2♂, Jackson, Wyo., altitude, 6300 ft.; July 13–17, 1920. All specimens collected by Dr. F. E. Lutz.

Odontomyia idahoensis, new species

Figure 5

This species runs to *O. pubescens* Day in Curran's key, and to *O. rufipes* Loew in Johnson's key; but it is easily distinguished from both. It is probably closest to the Cuban *O. rufipes*, which I have not seen.

MALE.—Face and ocellar triangle black; oral margin and a spot to each side of it, yellow. Proboscis black; base brownish yellow; palpi yellow. First two segments of the antennæ black; third missing in the type; probably black. Eyes reddish brown. Occiput velvety black. Thorax wholly black; pile yellow, moderately dense, erect on dorsum, somewhat appressed on the pectus. Scutellum black, lateral and apical margins yellow; spines short, thick, sharp, black. First, fourth, and fifth segments of the abdomen largely black, the fourth with lateral margins, widest posteriorly, the fifth with somewhat obsolete lateral and evident posterior margins; second and third segments largely yellow, each with a large black vertebra-shaped marking which connects with the adjoining segments to form a continuous median line and extends laterally to within a short distance of the lateral margin, the approach being greatest anteriorly. Venter yellow; legs wholly reddish yellow, the tarsi darkened. Wings hyaline; veins yellow; third vein branched. The posterior cell emits three veins, the third one rather indistinct. Length, 12 mm.; width of abdomen, 4.5 mm.; length of abdomen, 5.5 mm.

HOLOTYPE.—♂; Bear Lake, Idaho, altitude, 6200 ft.; July 9, 1920.

Odontomyia truquii currani, new variety

This specimen, which was sent to me by Mr. C. H. Curran, I should hardly consider as representing a distinct species, though it is undoubtedly a distinct variety of the variable *O. truquii* Bell. The best distinguishing feature is the black base of the scutellum, which is also black-haired for its entire width. In the typical form, the scutellum is green, while in *O. truquii innotata* Curran, the scutellum may be green or black at the base, but the black does not attain the margins. Of the two known American varieties, this specimen more nearly agrees with the typical variety in the general appearance and in the detail of the abdominal markings; but the fifth abdominal segment is somewhat narrower in proportion to the fourth. It agrees with the variety *innotata* in lacking the two pale markings of the dorsum of the thorax. The sides of the dorsum are black, except the posterior angles, which are green.

HOLOTYPE.—♂; Kits Peak, Rincon, Baboquivari Mts., Ariz., altitude, 4050 ft.; August 1–4, 1916; F. E. Lutz.

Nemotelus flavicornis, new species

If it were not for the yellow antennæ and the more pointed, contracted facial prominence, this species would quite easily pass for *N. unicolor* Loew, of which it may be only a variety. The body is black and more shiny than in most specimens of *N. unicolor* which I have for comparison. The eyes are round. The antennæ are situated at about the center of the facial prominence. Dorsum of thorax narrowly margined with yellow. Halteres yellow; the knob largely brownish. Basal two-thirds of femora and a band on each of the hind tibiæ, black; remainder of femora, tibiæ, and tarsi yellow. Length, 4 mm.

TYPE.— ♀; Lawrence, Kansas; June 5, 1922 (C. H. Curran).

AMERICAN MUSEUM NOVITATES

Number 572 | Published by The American Museum of Natural History, New York City | Oct. 10, 1932

59.57, 89 P (87)

PIERIDÆ FROM THE REGIONS OF MT. DUIDA AND MT. RORAIMA

By F. Martin Brown

The material reported herein was collected by Mr. G. H. H. Tate and his associates of the Tyler Duida Expedition, 1928–1929, and of the Day Roraima Expedition of 1927–1928. The first-mentioned expedition brought back to the American Museum about ninety specimens of Pieridæ, the latter only about one-fifth as many. However, each collection contained specimens of an undescribed species of the genus *Catasticta*. Excellent brief descriptions of the regions visited are to be found in two recent articles published in the January, 1930, issue of The Geographical Review.[1]

The Hesperiidæ have been reported upon by Mr. E. L. Bell, in American Museum Novitates, No. 555.

THE TYLER DUIDA EXPEDITION

The areas visited may be divided into two groups: the Rio Negro Forest area and the Cerro Duida area.

Rio Negro Forest Area

During the advance up the Rio Negro toward Mt. Duida in September, and the return journey the following March, occasional collecting was done. Most of this took place either early in the morning or toward sunset, but a few specimens were taken during the day from the boats.

Cerro Duida Area

Five types of localities are included in this area:

(1)—Esmeralda and Esmeralda Savanna, comprising the lowlands along the Orinoco River and forest and riverside savannas, which differ considerably in vertebrate fauna from the typical savanna at the foot of the mountains. Elevation about 400 feet.

[1]Tate and Hitchcock, 'The Cerro Duida Region of Venezuela,' XX, pp 31–52, and Tate, 'Notes on the Mount Roraima Region,' XX, pp. 53–68

Fig. 1. Upper side of *Catasticta duida*, new species. Male holotype, × 11/10.

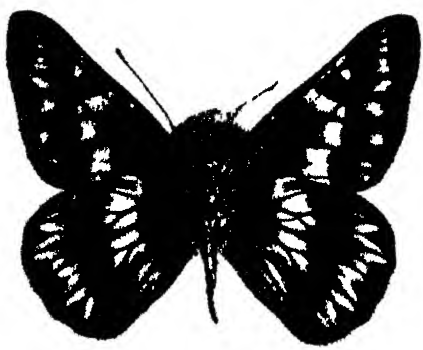


Fig. 2. Under side of *Catasticta duida*, new species. Male holotype, × 11/10.

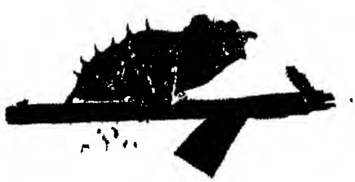


Fig 3. Chrysalis of *Catasticta duida* (?), new species. × 11/10.

(2)—Lowlands near the mountains, consisting mainly of savannas and forest. Name of station, Middle Camp.

(3)—Foothill Region, generally humid and clothed with tropical forest.

(4)—Foothill Region, local arid ridges.

(5)—Summit, wet subtropical condition.

Species from Duida

Catasticta duida, new species

Figures 1 to 3

Allied to *Catasticta amastris* Hewitson.

Upper Surface.—Intermediate to *C. amastris* Hewitson and *C. bithyna* Roeber Uniform, velvety black with the following white markings : an irregular submarginal row of small weak spots on both wings; and an irregular median band broken into rectangular spots on the forewing and extended on the hind wings to the anal nervule as a band within the cell, crossed by black nervules. Base of hind wing slightly grayish.

Under Surface.—Forewing, as above, but with the white spots larger; three yellow marginal dashes at the apex and the three white apical spots of the marginal band each containing a yellow dash; hind wings similar to *suasa* Roeber, with the appearance of five bands of color, three velvety brown-black and two white, the inner white band rather regular, the outer composed of angular spots, with the usual yellow markings; the marginal yellow spots are small and not triangular in shape; the basal and thoracic spots are yellow, not red Length of forewing 29 mm.

The females differ slightly in the wing-shape

Types.—Holotype, male, Mt. Duida, Venezuela, Dec. 9, 1928, alt. 6500 ft.; allotype, female, Mt. Duida, Venezuela, Dec. 9, 1928, alt. 6500 ft. Paratypes: five males, Mt. Duida, Venezuela, Dec. 9, 1928, alt. 6500 ft.; one male, Mt. Duida, Venezuela, Dec. 16, 1928, alt. 6500 ft.; one female, Mt. Duida, Venezuela, Jan. 5, 1929, alt. 6500 ft.; and one male, base of cliff, Mt. Roraima, Brazil, Oct. 28, 1927, alt. 7400 ft.; in collection of The American Museum of Natural History.

This species differs from *amastris* Hewitson, on the upper surface, in the extensions of the white markings. On the underside *duida* differs in the white ground color of the hind wings as compared with the yellowish ground color of *amastris*. From *bithyna* Roeber it differs above in the restriction of the white markings and beneath in the totally different types of hind wing markings, which in *bithyna* are similar to the *pitana* group.

All of the Duida specimens were collected on "Ridge 23B" (see Geographical Review, XX). A chrysalis was found on this ridge. It may belong to this species. In general structure it resembles the chrysalis of *Pereute* but differs markedly in the head appendages.

Appias drusilla Cramer

One male, Rio Negro, between Tatu and Pirapucu, Brazil, Sept. 24, 1928; one male, Rio Negro, San Carlos, Venezuela, Sept. 24, 1928; four males, Mt. Duida, Middle Camp, forest, Nov. 6, 1928, alt. about 600 ft.; two males, Mt. Duida, Middle Camp, forest, Nov. 13, 1928, alt. about 600 ft.

Two of the specimens taken September 6, 1928, show great reduction of the black apical area of the forewing; all of the others are typical. The Mt. Duida specimens were taken in the light-trap or settling about the moist spots in the clearing.

Daptonoura lycimnia form **mœsia** Fruhstorfer

One male, Mt. Duida, Foothills Camp, forest, Nov. 15, 1928, alt. 1000 ft. A typical Amazon forest form.

Anteos menippe Huebner

Three males, Rio Negro, San Carlos, Venezuela, Sept. 24, 1928; one male, Mt. Duida, Esmeralda, Oct. 29, 1928, alt. 325 ft.; one male, Mt. Duida, Esmeralda Savanna, Nov. 2, 1928, alt. 325 ft.; three males, Mt. Duida, Foothills Camp, forest, Nov. 15, 1928, alt. about 1000 ft.

The Foothills Camp specimens were taken on a small beach on the Caño Base.

Eurema albula form **sinoë** Godart

One male and one female, Mt. Duida, Caño Base Playa forest trail, Nov. 14, 1928, alt. about 1000 ft.

Eurema dina leuce Boisduval

One male, Mt. Duida, Foothills Camp, forest, Nov. 19, 1928, alt. about 1000 ft.

Phœbis philea philea Linnæus

One male, Mt. Duida, Esmeralda Savanna, Oct. 27, 1928, alt. 325 ft.; one male, Mt. Duida, Esmeralda Savanna, Oct. 29, 1928, alt. 325 ft.

Phœbis argante argante form **hersilia** Cramer

One male, Rio Negro, Santa Izabel Brazil, Sept. 8, 1928; two males, Rio Negro, San Carlos, Venezuela, Sept. 24, 1928; one male, Mt. Duida, Esmeralda, Oct. 27, 1928; two males, Mt. Duida, Esmeralda, Nov. 21, 1928.

Phœbis rurina Felder

Five males, Mt. Duida, Foothills Camp, forest, Nov. 15, 1928, alt. about 1000 ft.

Specimens taken on the damp sands of a small beach on the Caño Base.

Phœbis (Rhabdodryas) trite trite Linnæus

One male, Rio Casiquiare, between Cururi and Quemapure, Venezuela, Sept. 27, 1928; three males, Mt. Duida, Esmeralda Savanna, Oct. 27, 1928, alt. 325 ft.; one female, Mt. Duida, Foothills Camp, forest, Nov. 19, 1928, alt. about 1000 ft.

The Foothills Camp specimen is badly battered.

Aphrissa statira statira Cramer

One male and one female, Rio Negro, Santa Izabel, Brazil, Sept. 8, 1928; one male, Rio Negro, 35 miles above Santa Izabel, Sept. 10, 1928; one male, Rio Negro, Yucabi, Brazil, Sept. 13, 1928; fourteen males, Mt. Duida, Esmeralda Savanna, Oct. 27, 1928, alt. 325 ft.; eleven males, Mt. Duida, Esmeralda Savanna, Nov. 2, 1928, alt. 325 ft.; eight males, Mt. Duida, Middle Camp, forest, Nov. 13, 1928, alt. about 600 ft.; one male, Mt. Duida, Ridge 23B, Jan. 9, 1929, alt. 6500 ft.; one female, Mt. Duida, Summit, Savanna Hills, Feb. 2, 1929, alt. 4500 ft.

Aphrissa statira statira form **wallacei** Butler

One male, Mt. Duida, Esmeralda Savanna, Nov. 2, 1928, alt. 325 ft.

Aphrissa statira statira aberration male **etiolata** Forbes

One male, Mt. Duida, Esmeralda Savanna, Oct. 27, 1928, alt. 325 ft.; one male, Mt. Duida, Middle Camp, forest, Nov. 13, 1928, alt. 600 ft

Dismorphia viridifascia Butler

One male, Mt. Duida, Summit, Central Camp, Valley Head, Jan. 2, 1929, alt. 5000 ft.

This individual differs from typical Central American specimens. It has the spots on the upper surface of the forewing almost obliterated, and the green area on the hind wing slightly reduced. Incidentally, this is the only South American specimen that I have seen. It is apparently rare in Central America and is restricted to the slopes of the highest

volcanic peaks of Panama and Costa Rica, such as Chiriqui and Irazu. The Central American specimens, which I have seen, were taken below 8000 ft.

THE DAY RORAIMA EXPEDITION

Five camps were occupied in the vicinity of the mountain: Arabupu, 4200 ft., on the river of the same name; Paulo, 4000 ft., on the Cuquenam River, eight miles southwest of the plateau; Philipp Camp, 5200 ft.; Rondon Camp, at the base of the talus, 6900 ft.; and Summit Camp, 8600 ft. Arabupu was the only good collecting place for butterflies.

Nine days of the return trip to Georgetown, British Guiana, were spent at Anundabaru, on the headwaters of the Potaro River, about one hundred miles east of Mt. Roraima.

Species from Roraima

Catasticta duida Brown

One male, Mt. Roraima, at the base of the cliff, Oct. 28, 1927, alt. 7400 ft.

One of the paratypes of the species.

Eurema albula Cramer

One male, Mt. Roraima, Arabupu, Dec. 26, 1927, alt. 4200 ft.

Eurema albula form **sino** Godart

One male, Mt. Roraima, Paulo, Nov. 5, 1927, alt. 4000 ft.; one male, Mt. Roraima, Arabupu, Dec. 31, 1927, alt. 4200 ft.

Phœbis philea philea Linnæus

Five males, Mt. Roraima, Arabupu, Dec. 1927, alt. 4200 ft.

Phœbis rurina Felder

Three males, Mt. Roraima, Arabupu, Dec. 1927, alt. 4200 ft.

Aphrissa statira statira Cramer

Two males, Mt. Roraima, Arabupu, Dec. 1927, alt. 4200 ft.

Species from Anundabaru

Dismorphia pinthæus Linnæus

One male, Anundabaru, Potaro River, Jan. 1928, alt. 2000 ft.

Appias drusilla Cramer

One male, Anundabaru, Potaro River, Jan. 1928, alt. 2000 ft.

There are two interesting species listed from these mountains: one, the new *Catasticta duida,* belonging to a strictly Andean group of the genus; the other, the Central American *Dismorphia viridifascia,* on Mt. Duida. All of the other species are commonly found throughout northern South America.

AMERICAN MUSEUM NOVITATES

Number 573 | Published by The American Museum of Natural History New York City | Oct. 11, 1932

59.88,1 C (728)

THE CENTRAL AMERICAN FORMS OF THE MUSICIAN WREN, *CYPHORHINUS LAWRENCII* LAWRENCE

By John T. Zimmer

A short time ago, I was asked by Dr. C. E. Hellmayr to make comparisons of certain specimens of *Cyphorhinus* in this country for use in his forthcoming discussion of the American Troglodytidae. A critical examination of the cotypes of *C. l. lawrencii*, made in this connection, has led to the belief that a rearrangement of the Central American members of the group is necessary. Through the kindness of Mr. Todd, of the Carnegie Museum, Pittsburgh, Mr. Peters, of the Museum of Comparative Zoology, Cambridge, and Dr. Friedmann, of the U. S. National Museum, Washington, I have been able to supplement the series of specimens already at hand in this museum and to give a more comprehensive review of the situation than would, otherwise, have been possible. Many thanks are hereby expressed for this generous assistance.

Starting first with *lawrencii*, itself, it is apparent that Lawrence had at least three specimens, all from Lion Hill, Panamá (=Canal Zone). Two of these are marked as "type" on the labels but the third (a partially albinistic specimen) bears no such designation though it is mentioned by Lawrence in the original description (Ann. Lyc. Nat. Hist. N. Y., VIII, p. 5, 1863). In the absence of a single specimen alone designated as type, all three of Lawrence's original specimens should be taken as cotypes.

In addition to these three skins, I have examined five more from the Canal Zone (including three from Loma del León or Lion Hill) and one from La Chorrera, just west of the Pacific end of the Canal Zone. These birds all unquestionably represent true *lawrencii*. Nineteen skins from the extreme eastern end of Panamá are not distinguishable from the Canal Zone birds and must also be referred to *lawrencii*. Eight examples from Saotata, Río Atrato, Colombia, topotypes of *C. l. assimilis*, also seem to be inseparable from *lawrencii*.

Some of the skins from Saotata are a little paler brown on the upper surface than Canal Zone and eastern Panamá birds, with a very slight olivaceous tone, but at least one Saotata example is darker than the

Canal Zone specimens. Lawrence's male cotype has the belly no paler than the breast but both female cotypes have the abdomen noticeably paler, grayish white in one, more buffy in the other. They can be matched by some of the Saotata specimens. Another topotypical female and the male from La Chorrera have the same character and even certain Costa Rican examples, of which more will be said later, show the belly distinctly whitish. The characters of *assimilis*, therefore, appear to be shared with *lawrencii* though perhaps they may be more constant in the region of the lower Río Atrato.

If *assimilis* is to be recognized as distinct, it must have a very restricted range at the mouth of the Río Atrato in northwestern Colombia. Farther up the Atrato, at Alto Bonito, the resident form unquestionably is *C. l. phaeocephalus* as already recorded by Chapman (Bull. Amer. Mus. Nat. Hist., XXXVI, p. 527, 1917), and the skins from the adjacent portion of eastern Panamá are *lawrencii*. It seems more probable that *assimilis* represents the most extreme elements of *lawrencii*, though unfortunately it is antedated by Lawrence's form.

It may be of interest to note that one of Lawrence's females has the entire throat white in a broad gular patch as described by Lawrence himself, while a male from the Río Sambú and another male from Tacarcuna, eastern Panamá, have the same characteristic. Numerous skins show traces of white or whitish at the bases of some of the feathers of the throat and sides, and a male from El Real, eastern Panamá, has one or two white feathers on the upper throat. Albinism in this form apparently has a tendency to concentrate somewhat frequently in the gular region. Incidentally, the tone of rufous in the throat and breast is extremely variable without any geographical significance.

Four skins from Nicaragua and one from British Honduras are very like the Canal Zone birds though they show some very slight differences. There is possibly a faintly greater tinge of rufescence in the brown of the lower flanks and the rump in the Nicaraguan and Honduran examples; the bars on the wings and tail are a little less sharp and clear; the malar region has the blackish area adjoining the base of the bill averaging smaller; the belly does not reach the extreme of paleness that is found in *lawrencii;* the bars on the lesser upper wing-coverts are sometimes obsolete, though sometimes well developed. These differences are not striking and would hardly be sufficient for the recognition of a distinct form if the range were continuous with that of *lawrencii*, but the Caribbean slopes of Costa Rica are inhabited by a very different subspecies, completely separating Nicaragua and Honduras from the country in-

habited by *lawrencii*. It is necessary, therefore, to resurrect the name "*richardsoni*," applied by Salvin (Bull. Brit. Orn. Club, VI, p. xxxii, 1893) to Nicaraguan examples. More material from Nicaragua and British Honduras may show characters additional to those I have mentioned.

Fourteen Costa Rican birds are decidedly darker than the series of *lawrencii* and *richardsoni*, and a single skin from Almirante, western Panamá, agrees with the Costa Rican examples. So constant is the difference that it is advisable to name a new form from this region. Accordingly it may be known as follows.

Cyphorhinus lawrencii infuscatus, new subspecies

TYPE from Carrillo, Costa Rica, altitude 1000 feet. American Museum of Natural History, Dwight Collection No. 57,595. Adult male collected April 25, 1924, by Austin Smith.

DIAGNOSIS.—Darker than either *C. l. lawrencii* or *richardsoni;* forehead and crown often distinctly blackish; abdomen less distinctly whitish than in most *lawrencii;* malar region with reduced amount of blackish as in *richardsoni.*

RANGE.—Caribbean lowlands of Costa Rica and western Panamá.

DESCRIPTION OF TYPE.—Forehead and crown blackish; hinder part of head, neck, and mantle Mummy Brown x Prout's Brown[1]; rump Prout's Brown x Mars Brown; upper tail-coverts a little brighter on the margins. Lores blackish at the tips of the feathers, dark rufous at the base; a small area in the malar region at the base of the bill dusky; remainder of the sides of the head, including a stripe over the auriculars Chestnut x Sanford's Brown, the color continued over the chin, throat, and upper breast; sides of neck and sides of breast a little paler than the mantle, continuous in color with the upper flanks; lower flanks deepening to Argus Brown x Brussels Brown; lower breast and belly Buffy Brown, with slightly paler margins which are somewhat tawny on the lower breast; under tail-coverts margined broadly with deep Sanford's Brown x Burnt Sienna. Feathers of occiput, nape, mantle, sides of neck, and sides of breast with broad white bases. Wings externally somewhat brighter and slightly more rufescent than the back, strongly barred with narrow blackish lines which are continued more narrowly and less prominently on the upper wing-coverts, becoming subobsolete on the lesser series; under wing-coverts and axillars Pinkish Cinnamon; inner margins of remiges Vinaceous Buff. Tail dark Mars Brown x Prout's Brown above, paler on the under side, barred like the outer margins of the remiges with black. Bill black (in dried skin); lower margin of mandible somewhat paler; feet dark brown. Wing, 68 mm.; tail, 31; exposed culmen, 19; culmen from base, 22; tarsus, 24.

REMARKS.—An occasional skin from Costa Rica is lighter than the others, approaching the darkest *lawrencii*, but there is no actual over-

---

[1]Names of colors when capitalized indicate direct comparison with Ridgway's 'Color Standards and Color Nomenclature.'

lapping. When the birds are laid out in series the difference is quite pronounced.

The color of the throat is too variable in each form to be of any assistance. The color of the malar region is more useful though it varies also. The Costa Rican birds have an occasional touch of blackish adjacent to the base of the bill (as in the type of *infuscatus*) but many skins lack it completely and have this region uniform with the throat. On the other hand, *lawrencii* usually has a distinct blackish patch in that position, sometimes extensive and rarely absent. Both series occasionally have the lores rufescent, and sometimes have the rufous color extended over the eye in a superciliary stripe. This is of more frequent occurrence in *lawrencii* where, also, the forehead is sometimes noticeably tinged with rufous. One topotype of "*assimilis*" has the whole forehead strongly pale rufous, suggesting the pattern of the *modulator* group. Most skins of *lawrencii* have the rump hardly brighter than the mantle while *infuscatus* has it somewhat warmer, though the rufescence is masked by the general blackish tone of the entire upper surface. The occasional whitish tint of the belly has already been mentioned.

The name *Cyphorhinus* (Cabanis, 1844) long applied to this genus, was dropped by Richmond (Auk, XIX, p. 92, 1902) because of an earlier *Cyphorhina* (Lesson, 1843), and *Leucolepis* (Reichenbach, 1850) was used as the next available name. Under the 'International Rules of Zoological Nomenclature,' *Cyphorhina* does not disqualify *Cyphorhinus* which should be reinstated as the earliest name for the genus.

SPECIMENS EXAMINED

C. l. lawrencii.—PANAMÁ: (Lion Hill), 1 ♂ (cotype), 2 ♀ (cotypes); Loma del León (Lion Hill), 2 ♂[1], 1 ♀[1]; Gatun, 1 ♂; Barro Colorado Island, 1 ♀; La Chorrera, 1 ♂; Tacarcuna, 5 ♂, 4 ♀; Capeti, Darien, 1 (?); Tapalisa, 1 ♂; Chepigana, 1 (?); El Real, Río Tuyra, 2 ♂, 2 ♀, 1 (?); Río Sambú, 1 ♂, 1 ♀. COLOMBIA: Saotata, Río Atrato, 4 ♂[2], 3 ♀[2], 1 (?).[2]

C. l. richardsoni.—NICARAGUA: Los Sábalos, 2 ♂, 1 ♀, 1 ♀[3]. BRITISH HONDURAS: Segovia River, 1 ♀.[3]

C. l. infuscatus.—COSTA RICA: Atirro, 1 ♀; Carrillo, 3 ♂, 2 ♀; Parismina, 2 ♂, 2 ♀; Guacimo, 1 ♂, 1 ♀; Guapiles, 1 ♂, 1 ♀. PANAMÁ: Almirante, Boca del Toro, 1 ♂.

C. l. phaeocephalus.—COLOMBIA: Alto Bonito, 3 ♂; Baudo, 1 ♂, 2 ♀; Barbacoas 1 ♀; Puerto Valdivia, 1 ♀. ECUADOR: Esmeraldas, 4 ♂, 2 ♀; Río de Oro, 1 ♀, 1 (?); Cerro Manglar Alto, 1 ♂; Chimbo, 1 ♂, 1 ♀; La Chonta, 1 ♂, 1 ♀.

[1]Specimens in Museum of Comparative Zoölogy, Cambridge.
[2]Specimens in Carnegie Museum, Pittsburgh
[3]Specimen in U. S. National Museum, Washington.

AMERICAN MUSEUM NOVITATES

Number 574 | Published by The American Museum of Natural History New York City | Oct. 22, 1932

59.9, 32 S (728.1)

A NEW SQUIRREL FROM GUATEMALA

By George G. Goodwin

Since the publication of my latest report on collections of Guatemala mammals, I have found it necessary to describe a new form of *Sciurus yucatanensis*. This subspecies is based on a unique series of eleven specimens collected at low elevations in Central Guatemala.

Acknowledgment is due to Major E. A. Goldman for kindly comparing specimens with the type of *S. y. baliolus* and commenting on the relationships.

Sciurus yucatanensis phæopus,[1] new subspecies

Type.—No. 73106, Amer. Mus. Nat. Hist.; male, adult; Secanquim, District of Alta Verapaz, Guatemala; 1600 feet elevation; January 31, 1926; collector, A. W. Anthony. The type is a skin and skull in good condition.

General Characters.—Size medium, tail about equal in length to head and body; color dark; underparts normally finely mixed buffy and black; fore limbs and hind feet black; similar in general characters to *S. y. baliolus* but differing in its uniformly darker color, and most conspicuously in the accentuation of the darker marking.

Description.—Color above, uniform ochraceous buff heavily overlaid with black-tipped hairs; a small buffy patch on face above nose; sides of head from base of nose and above eye to ear black, finely mixed with buffy; ring around eye, narrow and dingy whitish; ear, outerside of anterior margin and inner side of posterior margin black, rest of ear like back, basal patch and small tuft at tip buffy; conspicuous black patch at posterior base of ear; upper surface of fore and outer side of hind limbs, fore and hind feet nearly clear glossy black, faintly flecked with buffy; tail at base like back, rest of tail above black lightly washed with white, below nearly clear black, edged with white, medium area buffy. Underparts including underside of fore limbs and hind limbs to tarsus finely mixed light ochraceous buff and black, grayer on throat and lower part of cheeks; lips and sides of nose dingy buffy white.

Variation.—The series examined, collected from January to May, does not show much variation in seasonal characters. Individual variation consists mainly in the accentuation of the dark markings; in some specimens the entire underparts are black, others have pure black limbs and feet, a decidedly dark facial mask, and are without pale basal ear-patch.

Cranial Characters.—Practically the same as in *Sciurus yucatanensis baliolus*.

Measurements of Type.—Taken in the flesh: total length, 485 mm.; length of tail vertebræ, 240 mm.; length of hind foot, 59 mm.; ear, from notch, 18 mm.

[1]*Phæopus* =dark-footed.

Skull: basal length, 46 mm.; palatal length, 28 mm.; interorbital breadth, 18 mm.; zygomatic breadth, 32 mm.; length of upper molar series, 10.2 mm.

Sciurus yucatanensis phæopus, compared with *S. y. baliolus* from southern Campeche, is similar in general characters but is darker in color everywhere. The limbs, especially, are darker. In dark specimens of *S. y. baliolus* the fore limbs and hind feet are usually blackish but not so deep or pure black as in the Guatemala specimens. The sides of the head are blacker in *S. y. phæopus*, with conspicuous black patches at the base of the ears, which are indistinct or absent in *S. y. baliolus*, the underparts are normally more buffy and less grayish, and the tail is more extensively black than in the latter species.

Besides the type there are four paratypes and seven specimens from Finca Chama, 1200 feet elevation, thirty miles northwest of Coban. The type series was collected in a pine and oak forest at Secanquim, which is about fifty miles east of Coban.

AMERICAN MUSEUM NOVITATES

Number 575 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Oct. 22, 1932

56.9 (1181:82.9)

SOME NEW OR LITTLE-KNOWN MAMMALS FROM THE *COLPODON* BEDS OF PATAGONIA.[1]

BY GEORGE GAYLORD SIMPSON

The expeditions of Professor F. B. Loomis for Amherst College and of Mr. E. S. Riggs for the Field Museum of Natural History did extensive work in the *Pyrotherium* and *Colpodon* Beds of Patagonia, greatly supplementing the pioneer work of the brothers Ameghino. It was the chief purpose of the Scarritt Patagonian Expedition of The American Museum of Natural History to do a similar service for the still earlier and less known *Notostylops* fauna, and most of our collecting was confined to this and the associated *Astraponotus* fauna. Nevertheless for purposes of stratigraphic determination and to supplement the Museum collections, some work was done also on the two faunas which intervene between the *Astraponotus* Beds and the great marine Patagonian Formation: the *Pyrotherium* and *Colpodon* faunas of Ameghino.

By an arrangement between the two institutions, it is planned that the two earlier faunas, *Notostylops* and *Astraponotus*, shall be revised at the American Museum, and the two later, *Pyrotherium* and *Colpodon*, at the Field Museum, but in each case a few especially interesting or complete specimens will first be described briefly and published by the museum for which they were collected.

The present paper is the first of three in which a few of the specimens found by the Scarritt Patagonian Expedition in the *Pyrotherium* and *Colpodon* Beds will be briefly described and discussed. It includes the new marsupial material (other than borhyænids), a new ground sloth, and a new rodent specimen, all from the *Colpodon* Beds. The next paper will be devoted to some interesting ungulate specimens from the *Pyrotherium* and *Colpodon* Beds, and another to the osteology and affinities of the typothere *Cochilius* of the *Colpodon* fauna. In this paper is also included a new species of marsupial found by the Field Museum party.

In addition to the courtesy of Dr. Doello-Jurado, don Carlos Ameghino, and others in connection with the study of the Ameghino Collection in Buenos Aires, so useful in the whole series of studies of which this is one, I am now further indebted to Drs. W. B. Scott and W. J. Sinclair

[1]Publications of the Scarritt Patagonian Expedition, No. 7.

of Princeton University for copies of photographs of various of the Ameghino types taken by Professor Scott, and for permission to reproduce some of them. The drawings in this paper are by Mildred Clemans.

MARSUPIALIA

Material collected by the Scarritt Patagonian Expedition in the *Colpodon* Beds south of Lago Colhué-Huapí includes nine specimens referable to marsupials other than borhyænids. These are of unusual interest, as they include a new species of *Microbiotherium*, two fine specimens of *Abderites crispus* Ameghino, and three specimens of a new and peculiar genus of Abderitinæ. *Homunculites pristinus* (which appears to be a marsupial, as pointed out by Bluntschli) and *Palæpanorthus primus* are also represented, but by specimens not adding to previous knowledge.

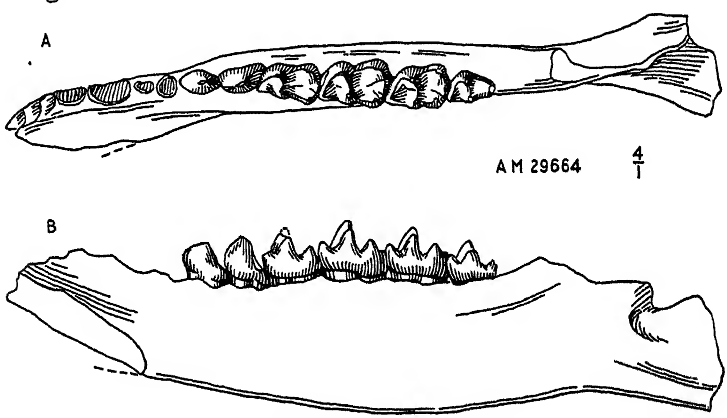


Fig. 1. *Microbiotherium hernandezi*, new species. Type, Amer. Mus. No. 29664, right lower jaw. A, Crown view. B, Internal view. Four times natural size.

DIDELPHIIDÆ

Microbiotherium hernandezi[1], new species

TYPE.—Amer. Mus. No. 29664, right lower jaw with crowns of P_2-M_4 and alveoli of other teeth. Collected by Justino Hernández.

HORIZON AND LOCALITY.—*Colpodon* Beds south of Lago Colhué-Huapí, Chubut, Argentina.

DIAGNOSIS.—About the size of *M. tortor*. Premolars in contact, but not obliquely placed, all of nearly equal length. P_3 not higher than M_{1-3}. M_4 proportionately smaller than in *M. tortor*. Molars typical of the genus in structure. Symphysis slender.

[1]Justino Hernández, field member of the expedition.

Pachybiotherium Ameghino, from these same beds, is probably synonymous with *Microbiotherium*, being distinguished only by having the lower jaw bowed or curved laterally, a feature of doubtful significance and no generic value when accompanied, as it seems to be, by full agreement in dental structure. The present species, however, is much smaller than the sole species assigned by Ameghino to *Pachybiotherium*, *P. acclinum.* The only other possible didelphid yet described from the *Colpodon* Beds is *Oligobiotherium divisum.* This nearly agrees with the present species in size, but Ameghino describes this form as having only two trigonid cusps on M_3 and only one on M_4, M_3 with the talonid cusps in a straight transverse series, and M_4 with a large basined talonid—characters so distinctive that it is doubtful whether *Oligobiotherium* belongs in this family at all.

There seems to be no character by which this earlier species can be excluded from the Santa Cruz genus *Microbiotherium*, although it differs from each of the known Santa Cruz forms in minor characters, such as size and tooth emplacement and proportions.

A character common to all microbiotheres in the broadest sense and not fully brought out by Sinclair's material is well shown by this fine specimen. In the whole group M_4 is reduced, in varying degree in various species or genera, and has the talonid especially very much reduced, narrower and shorter than the trigonid, slightly basined and with a single median posterior cusp. The trigonid is normal except that paraconid and metaconid tend to be more nearly equal than on M_{1-3}.

Measurements.—M_{1-4}–7.8 mm.

CÆNOLESTIDÆ

Cænolestinæ

Ameghino recorded the presence of this subfamily (his Garzoniidæ) in the *Colpodon* Beds as follows (1902, p. 55): "GARZONIA, sp. Quelques débris, indiquent l'existence d'une espèce de ce genre, de taille excessivement petite, mais ils sont insufisants pour une détermination plus précise." This may refer to the species described below. *Pitheculites minimus* was also described from these beds by Ameghino, who considered it as a primate ancestral to the recent Neotropical primates, to the anthropoid apes, and to man. It is very clear, however, that *Pitheculites* is also a member of the Cænolestinæ, and hence, of course, has nothing to do with the primates.

Halmarhiphus riggsi,[1] new species

Type.—Field Museum No. P13639. Fragment of left lower jaw with M_{2-3} and broken M_4.

Horizon and Locality.—*Colpodon* Beds, south of Lago Colhué-Huapí, Chubut, Argentina.

Diagnosis.—Length M_{2-3}–3.3 mm. Trigonid considerably narrower than talonid on both M_{2-3}. M_4 long and narrow, two-rooted. Horizontal ramus very shallow in proportion to size of teeth.

The very characteristic molar structure of this species is identical with that of *Halmarhiphus nanus* (and presumably other species of the genus) of the Santa Cruz Formation. Especially noteworthy are the small trigonids, little if any higher than the talonids but not so deeply basined, with two main cusps, the inner one bifid at the tip, and a small anterior median projection. The size and various proportions of teeth and jaw are different in the present form from any Santa Cruz species, but because of this identity in molar structure I do not feel justified in making a new genus for this earlier species, although this might prove necessary were it more fully known.

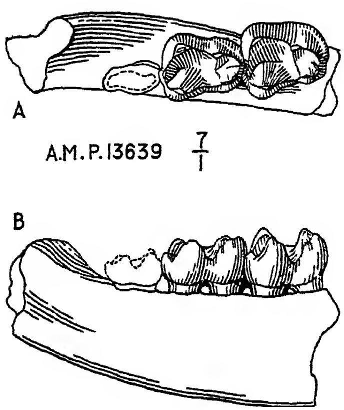


Fig. 2. *Halmarhiphus riggsi*, new species. Type, Field Mus. No. P13639, left lower jaw. A, Crown view. B, Internal view. Seven times natural size.

H. riggsi is very slightly smaller than *Pitheculites minimus*, in which M_{2-3} are said to measure 3.5 mm. in length. On this basis the two would appear probably synonymous, but if Ameghino and his artist have correctly described and figured *Pitheculites*, its molar structure differs. The trigonids appear to lack the median anterior fold, to lack the characteristic tall, bifid structure of the inner cusp and in general to be less reduced relative to the talonids. If the teeth are correctly placed by Ameghino, *Pitheculites* also has M_3 wider than M_2, rather than narrower as in *Halmarhiphus*, but his specimen may have been M_{1-2} rather than M_{2-3}. It is possible that *Halmarhiphus riggsi* is the same species as *Pitheculites minimus*, but this can be true only if Ameghino's description and figures are incorrect in detail, an unwarranted assumption.

---

[1]E. S. Riggs, leader of the First Marshall Field Palæontological Expedition to Argentina and Bolivia.

In any event they are related, at least closely enough to be placed in the same subfamily.

I am indebted to E. S. Riggs and other authorities of the Field Museum for the opportunity to include this specimen in the present study. Bryan Patterson had already examined it and recognized it as a probably new cænolestine.

ABDERITINÆ

Abderites crispus Ameghino

A. crispus, AMEGHINO 1902, p. 120.

Amer. Mus. Nos. 29663 and 29667 may be referred to this species.

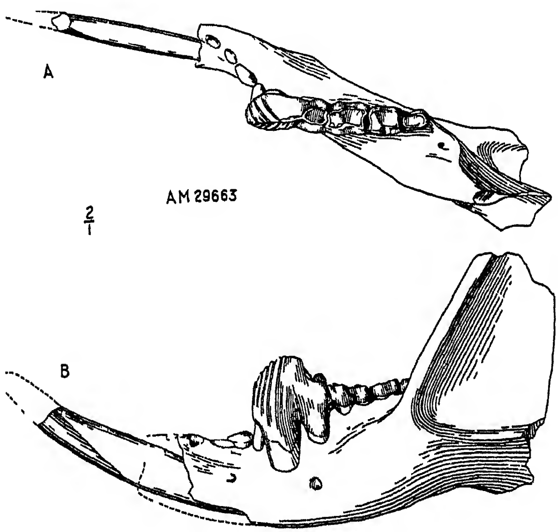


Fig. 3. *Abderites crispus* Ameghino. Amer. Mus. No. 29663, left lower jaw. A, Crown view. B, External view. Twice natural size.

The former is a left lower jaw with the incisor, P_{2-3}, and M_{1-4}, and is thus one of the most perfect specimens of any member of this subfamily yet described. The jaw is short and deep, rodent-like in its marked obliquity to the cheek tooth series The large, laterally compressed incisor extends upward well above the dental border level, and had, except probably at the very tip (broken), a limited band of enamel on the lower part of the outer face; the root is closed. It was followed by four spaced, single-rooted, vestigial teeth, the last of which (the only one

with crown preserved) has a simple, flattened, oval, non-cuspidate crown. The next tooth, P_3, is also vestigial but of different form: styloid and stoutly buttressing M_1 by insertion into a notch in the anterior end of the latter, exactly as the penultimate premolar buttresses the large shearing tooth in *Ptilodus*. The shearing M_1 had six main ridges on the sides and corresponding apical denticles. The molars are worn, but clearly had separate trigonids and larger talonids, the trigonids with one *inner* and two *outer* cusps, the talonids with one main outer cusp and two or three minor and partly confluent inner cusps.

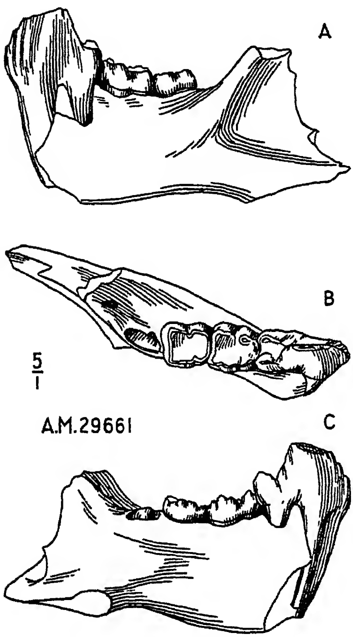


Fig. 4. *Micrabderites williamsi*, new genus and species. Type, Amer. Mus. No. 29661, left lower jaw. A, External view. B, Crown view. C, Internal view. Five times natural size.

Micrabderites,[1] new genus

TYPE.—*M. williamsi.*

DISTRIBUTION.—*Colpodon* Beds, Patagonia.

DIAGNOSIS.—Abderitinæ with M_1 notched anteriorly for P_3 as in *Abderites*, M_1 with few striæ and denticles (three in type), trigonid and talonid poorly differentiated on M_2, not distinct on M_3, $M_{2\text{-}3}$ with three trigonid cusps, one internal and two external, and five talonid cusps, three internal with connate bases forming an anteroposterior crest and two external. Species minute.

This is clearly a close relative of *Abderites* but is too distinctive for inclusion in that genus. It does not appear to be more primitive, but may be considered as a separate dwarfed phylum of the subfamily. The relatively small number of serrations on M_1 suggests the contemporaneous *Parabderites*, but that genus has a large, shearing, two-rooted P_3, whereas in *Micrabderites*, as in *Abderites*, P_3 clearly was styliform and inserted in a notch in the base of M_1.

Micrabderites williamsi,[1] new species

TYPE.—Amer. Mus. No. 29661, left lower jaw with $M_{1\text{-}3}$. Found by Justino Hernández.

PARATYPES.—Amer. Mus. No. 29662, left lower jaw with $M_{2\text{-}3}$. Found by Justino Hernández.

---

[1] Μικρος, small + *Abderites*.
[1] Coleman S. Williams, member of the Scarritt Patagonian Expedition.

Amer. Mus. No. 29666, left lower jaw with M_{1-2}. Found by G. G. Simpson.

HORIZON AND LOCALITY.—*Colpodon* Beds, south of Lago Colhué-Huapí, Chubut, Argentina.

DIAGNOSIS.—Sole known species of the genus, length M_{1-3}–5.0 mm.

This is much the smallest species yet described in this subfamily and cannot be confused with any other.

MEASUREMENTS

Length M_{1-3}	4.9 mm.
M_1 length	2.5
M_2 length	1.4
M_3 length	1.0

XENARTHRA

MEGALONYCHIDÆ

Proschismotherium scarritti,[1] new species

TYPE.—Amer. Mus. No. 29659, lower jaws complete anterior to the dental foramina on both sides, with all left teeth and second and third right. Found by G. G. Simpson.

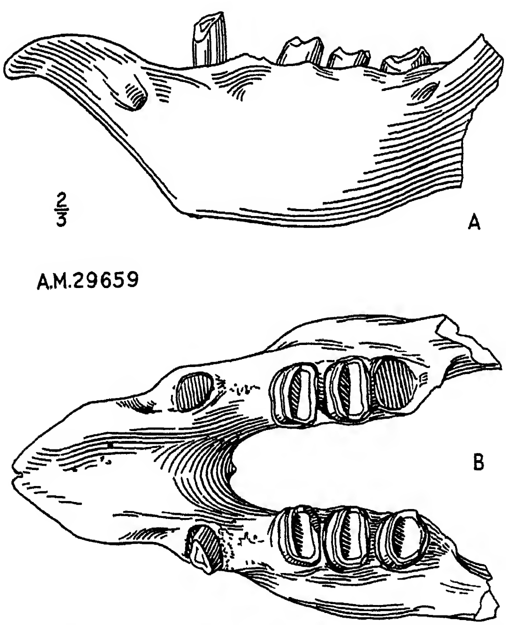


Fig. 5. *Proschismotherium scarritti,* new species. Type, Amer. Mus. No. 29659, lower jaw. A, Left lateral view. B, Crown view. Two-thirds natural size.

[1]Horace S. Scarritt, principal patron of the expedition.

Horizon and Locality.—*Colpodon* beds, south of Lago Colhué-Huapí, Chubut, Argentina.

Diagnosis.—A relatively large early gravigrade within the presumable size range of *Eucholœops ingens*, and 20–40% larger than *Proschismotherium oppositum*. First lower tooth large, triangular, with subequal anterior and external faces at right angles, the latter grooved vertically. Last lower tooth round to oval, long axis oblique. External margins of the four alveoli nearly in a straight line. Spout relatively large and wide for this genus. Symphysis steep, strong genial tubercle. Horizontal ramus deep and stout. External dental foramen well down on outer face, below posterior edge of last tooth.

Fig. 6. *Proschismotherium oppositum* Ameghino. Type, in Museo Nacional de Historia Natural, Buenos Aires. (The number refers to the photograph and is not a catalogue number.) Palatal view. Photograph by Professor W. B. Scott. About natural size.

Proschismotherium appears to be either synonymous with or closely related to the Santa Cruz genus *Eucholœops*. Ameghino's definition clearly shows that *Proschismotherium* is distinct from *Schismotherium*, but no really important difference from *Eucholœops* is shown by his specimen. The present specimen is referred to *Proschismotherium* tentatively because it comes from the horizon of that genus and, like it, closely resembles *Eucholœops*.

If correctly referred, this species tends in some measure to confirm the generic validity of *Proschismotherium*. It differs from all Santa Cruz species of *Eucholœops* in the relatively larger, more flaring spout, less strong notch anterior to the first tooth, somewhat distinctive shape and orientation of this tooth, and more backward inclination of the other teeth. In no case is the difference great, and each of these characters is nearly approached by some species of *Eucholœops*, but in sum they may suggest that the genera will prove distinct when better known.

Proschismotherium oppositum is known from the upper jaw only, but if the ratios were at all as in *Eucholœops*, as they must have been, the present species is at least 20% and perhaps as much as 40% larger, so that the two can hardly be synonymous. The only other known *Colpodon* Beds gravigrades are three species referred to *Hapaloides*, which differs from *Proschismotherium* (including *P. scarritti*) in the less external first teeth of upper and lower jaws, the same distinction as between *Hapalops* and *Eucholœops* in the Santa Cruz fauna. *P. scarritti* is also larger than any of the three species placed in *Hapaloides*.

Measurements

Length tip of spout to level of beginning of tooth series		35 mm.
Length lower tooth series (at alveoli)		47.5
Length, posterior three teeth		31.5
First tooth	Length	7
	Width	7
Second tooth	Length	8
	Width	11.5
Third tooth	Length	8
	Width	12
Fourth tooth	Length	9.5
	Width	10.5

RODENTIA

CHINCHILLIDÆ

Perimys incavatus Ameghino, 1902

To this species may be referred Amer. Mus. No. 29660, a skull lacking the rostrum, occiput, and basicranium, found by me in the *Colpodon* Beds south of Lago Colhué-Huapí. The specific reference is somewhat dubious. *Perimys transversus, Perimys incavatus,* and the present specimen are within about 5% of being the same size. Ameghino separated his two species on the basis of lower teeth, absent in our specimen, stating that in *P. transversus* the inner side is rounded except on M_3, while in *P. incavatus* it has a vertical groove on all the lower cheek teeth. Now, judging from the Santa Cruz species, this groove, never very much accentuated, is a somewhat variable feature both individually and with the degree of wear. This, with the improbability that two species so closely similar and of the same size really lived together, makes it at least possible that the species are synonymous. In any event, it would be preferable to retain the name *P. incavatus*. It was published a few lines below *P. transversus*, but at the same time, and priority of position is not legally imposed and should not weigh against

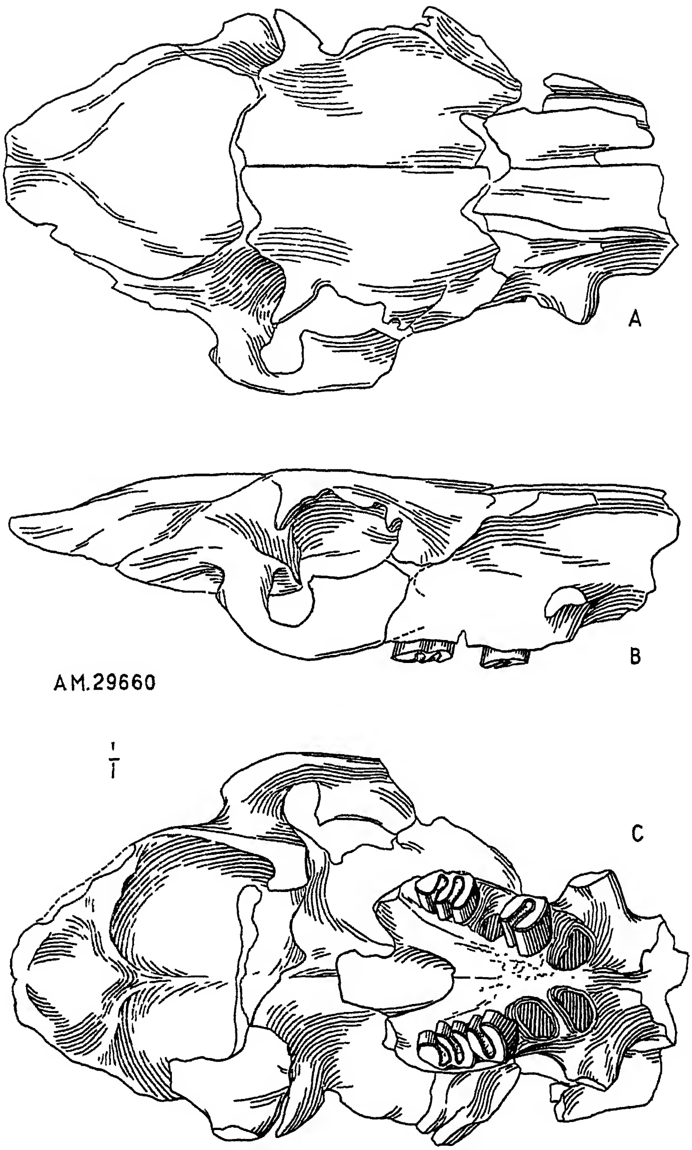


Fig. 7. *Perimys incavatus* Ameghino. Amer. Mus. No. 29660, partial skull. A, Dorsal view. B, Right lateral view. C, Palatal view. Natural size.

the fact that *P. incavatus* was based on a much better type and was more fully and accurately defined.

Ameghino had a partial skull of *P. incavatus* but did not figure or fully describe it. The chief interest lies in comparison with the Santa Cruz species of the genus, particularly with *P. impactus*, *P. puellus*, and *P. erutus*, of which Scott has described partial skulls. The general result of this comparison is that the *Colpodon* Beds form is quite distinc-

Fig. 8. *Perimys incavatus* Ameghino. Type, in Museo Nacional de Historia Natural, Buenos Aires. Palatal view. Photograph by Professor W. B. Scott. Slightly less than natural size.

tive, but not in any way that can be given definite phylogenetic significance. It does not appear to be more primitive so far as can be determined.

The size is slightly smaller than *P. impactus*, considerably larger than *P. puellus* or *erutus*, and about equal to *P. onustus*, judging from the lower jaw of the latter

P^4 is lost from our specimen, and M^{1-2} are not distinctive. M^3 differs from most or all of the Santa Cruz species in the character of the third lamella, which is relatively narrow (transversely) and long (antero-posteriorly), the two dimensions being nearly equal as opposed to the preponderance of the width in the later species. This tooth also has a shallow vertical external groove opposite the second lamella. Both these characters are also present in the type and seem to be true specific distinctions.

The palate is very narrow anteriorly, only 2 mm. between the alveoli of P_4, absolutely less than in the much smaller *P. erutus*. The choanæ

extend somewhat farther forward than in *P. impactus,* but not more than in *P. erutus*—Ameghino says that they are deeper in his type of *P. incavatus* than in any Santa Cruz species but the difference from our specimen is slight. The skull roof is chiefly remarkable for its flatness. The frontals are very feebly domed by sinuses, less so than in Santa Cruz species of comparable size. Most notable is the very slight flexure downward of the cranium with respect to the frontal region, the parietals lying nearly in the same plane as the frontals. This may in part be due to crushing, but not wholly so, particularly as the flatness of the skull roof was also noted by Ameghino in his type. The parietal crests are feebler than in *P. impactus* and, probably, other Santa Cruz species, and the sagittal crest is also relatively weaker and shorter although it is present. Its reported absence in Ameghino's type is merely due to its being broader than in our specimen. The postorbital processes are a little longer relatively than in *P. impactus,* and the notch in the superior orbital rim anterior to the postorbital process is sharply incised. In the anterosuperior margin of the orbit, in the position of the lacrymal and perhaps in that bone although this is not clear, are two small very deep notches, almost closed foramina. The zygoma is relatively somewhat stouter than in *P. puellus,* and the notch beneath or slightly anterior to the postorbital process very large and almost circular.

The roof of the endocranium is exposed, but it reveals nothing very noteworthy. The brain appears to have been much as in recent chinchillids and probably not proportionately smaller, with large, feebly convoluted cerebrum and almost fully exposed cerebellum.

REFERENCES

Ameghino, F. 1902. 'Première contribution à la connaissance de la faune mammalogique des couches à *Colpodon.*' Bol. Acad. Nac. Ci. Córdoba, XVII, p. 71 seq. [Also issued, and here consulted, as a separate paged 1–70.]

1906. 'Les formations sédimentaires du crétacé supérieur et du tertiaire de Patagonie avec un parallèle entre leurs faunes mammalogiques et celles de l'ancien continent.' An. Mus. Nac. Buenos Aires, XV (Ser. 3ª, VIII), pp. 1–568.

Scott, W. B. 1903–1904. 'Edentata of the Santa Cruz beds.' Rept. Princeton Univ. Exped. Patagonia, V, pt. I, pp. 1–364.

1905. 'Glires of the Santa Cruz beds.' Rept. Princeton Univ. Exped. Patagonia, V, pt. III, pp. 384–489.

Sinclair, W. J. 1906. 'Marsupialia of the Santa Cruz beds.' Rept. Princeton Univ. Exped. Patagonia, IV, pt. III, pp. 333–459.

AMERICAN MUSEUM NOVITATES

Number 576 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Nov. 3, 1932

56 9, 71 (1181:82 9)

NEW OR LITTLE-KNOWN UNGULATES FROM THE *PYROTHERIUM* AND *COLPODON* BEDS OF PATAGONIA[1]

BY GEORGE GAYLORD SIMPSON

In a previous paper of this series[2] some preliminary notes on fossil mammals from the *Colpodon* Beds were published. As there explained, revision of the *Pyrotherium* and *Colpodon* faunas is being undertaken at the Field Museum, and that of the *Notostylops* and *Astraponotus* faunas at the American Museum, but each is publishing some preliminary notes on some of its material which will be definitively treated at the other institution. The paper cited accordingly discussed some marsupials, edentates, and rodents from the *Colpodon* Beds, and the present paper similarly deals with some new ungulate specimens. The next communication will be devoted to the typothere genus *Cochilius*, and will be the last of this series to describe specimens later than the *Astraponotus* Beds. The drawings in this paper are by Mildred Clemans, and again I am indebted to Professor W. B. Scott for permission to publish photographs taken by him.

LITOPTERNA

Proterotheriidæ

Deuterotherium distichum Ameghino, 1895

Amer. Mus. No. 29554, found by me in the *Pyrotherium* Beds of Cabeza Blanca, is referred to this species. It consists of several skull fragments, incomplete but permitting a reasonably probable restoration, and thus adding significantly to our knowledge of pre-Santa Cruz litopterns.

The anterior part of the palate is poorly preserved. There are notches that may be alveoli, but they are too uncertain to be of any value. If alveoli, they indicate smaller and more numerous incisors than in later proterotheres. Ameghino stated that the dental formula was as in Santa Cruz proterotheriids, i.e. (by the standard notation, not Ameghino's), $\frac{1.0.4.3}{2.1.4.3}$, but this was based on a lower jaw, and he does not appear to have had anterior upper teeth. In any event, *Deuterotherium* did have at least one upper tooth not allowed for in this formula, either

[1] Publications of the Scarritt Patagonian Expedition, No. 8.
[2] Amer. Mus. Novitates, No. 575.

I^3 or C, a small, one-rooted tooth present on the left side of our specimen.[1] From this, a less certain general impression of the poorly preserved anterior end, and Ameghino's statements regarding the lower jaw, it appears that the diastemata were much shorter in *Deuterotherium* than in the Santa Cruz genera (except possibly *Thoatherium*) and that the incisors generally were less specialized. P^1 is lacking in the specimen, P^2 is badly worn, but has the long narrow triangular outline and more posterior internal heel of P^1 in the Santa Cruz, except in *Thoatherium*. P^3 was similar to P^4 but slightly less transverse and with smaller hypocone. The succeeding teeth have been described and figured by Ameghino, from a less worn specimen. The distinctive characters are

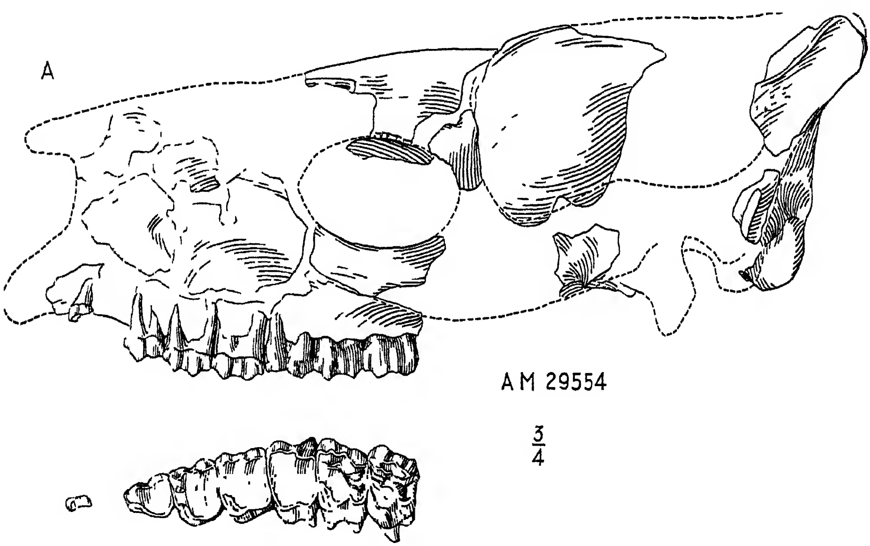


Fig. 1—*Deuterotherium distichum* Ameghino. Skull, Amer. Mus. No. 29554. A, Reconstruction of left lateral view, some parts reversed from other side. B, Left teeth, crown view. Three-fourths actual size.

the partly confluent but oblique protoconule—protocone—hypocone, relatively strong hypocone of M^3, absence of metaconule, weak external crests and no external cingulum, well developed anterointernal but no truly internal cingulum. Ameghino stated that the internal roots are separate here and fused in the Santa Cruz. They are more nearly equal in *Deuterotherium*, but they are not completely fused in such Santa Cruz specimens as I have examined.

[1] di^3 is sometimes present in young *Thoatherium*. The present individual is, however, old.

The frontal and parietal regions resemble those of Santa Cruz proterotheres, which differ among themselves only in rather minor and variable details. From the preserved postorbital process of the frontal, it appears that the orbit was already closed, and the characteristic foramina in the frontal are already present. In exact relationship, this region seems a little closer to *Proterotherium* than to *Thoatherium*, but the known differences are too slight to be significant. Much more important and definite is the occiput, which in *Deuterotherium* is of the characteristic *Thoatherium* type, high, steeply inclined, pointed above, with strong lambdoid crest flaring backward, not outward.

Ameghino, Loomis, Scott and, following them, all other authorities have placed *Deuterotherium* in the Proterotheriidæ. It is clear that the early proterotheres as they may be discovered, and probably including this genus, will not possess in the same degree the characteristic rostral protrusion, long diastemata, and rodent-like incisors which are commonly cited as defining the Proterotheriidæ. The easy separation of the litopterns into those with diastemata (proterotheres) and those without (macraucheniids) in the Santa Cruz will not hold in the earlier formations. There are, as was to be expected *a priori*, genera in the *Notostylops*, *Astraponotus*, and *Pyrotherium* Beds (e.g., *Xesmodon*, *Protheosodon*) that would be, and in some cases have been, placed in the Macraucheniidæ on this basis but which from the molar structure and other features probably do not really belong there.

Regardless of how far it may have progressed in the specialization of the anterior dentition, molar and skull structure seem fully to warrant retaining *Deuterotherium* in the Proterotheriidæ. Its closer relations within that group can be established with some probability.

The essential upper cheek tooth characters of the four definitely established Santa Cruz genera (Scott and original specimens) are:

Diadiaphorus.—P^{2-4} with hypocone strongly developed. On molars, protocone and protoconule partly confluent and ridge strongly oblique. Hypocone nearly separate. Metaconule present. Hypocone very small on M^3. Weak external, strong internal cingula.

Licaphrium.—Hypocone incipient on P^3, absent on P^2 and P^4. On molars, protocone and protoconule nearly as in *Diadiaphorus.* Hypocone less separate. Metaconule present. Hypocone present on M^3. Cingula variable, weaker internally than in *Diadiaphorus.*

Proterotherium.—Hypocone indicated on P^3, present on P^{3-4} but less separate than in *Diadiaphorus.* On molars, protocone, protoconule, and hypocone about as in *Diadiaphorus.* Metaconule present. No hypocone on M^3. Strong external, weak internal cingula.

Thoatherium.—P^2 without hypocone and smaller internal heel than in other genera; P^{3-4} with nearly connate hypocones. On molars, protocone, protoconule, and hypocone forming nearly continuous anteroposterior crest. Metaconule absent or indistinct. Hypocone present on M^3. No external or truly internal cingula.

Of these, *Deuterotherium* is more easily interpreted as a forerunner of *Thoatherium* than of any of the other genera. It agrees in the following points:

1. Shape and development of P^2—more like P^1 of the other genera.
2. Presence of hypocone on P^{3-4}.
3. Molar protoconule-protocone-hypocone more oblique and separate than in *Thoatherium*, comparable to *Licaphrium*, but a probable condition in the ancestry of *Thoatherium*.
4. Absence of metaconule.
5. Relatively strong hypocone on M^3.
6. No external or strictly internal cingula.

To these points of agreement are to be added the suggestion that in both *Deuterotherium* and *Thoatherium* the antemolar teeth are less reduced, the fact that they are less specialized and the still more positive agreement in the distinctive structure of the occiput. Against them there is little to cite except Ameghino's statement (1897, p. 48 of the separate) that "les molaires inférieures portent une tubercule interne dans le creux postérieur interne comme dans le genre *Licaphrium*, mais la dernière molaire inférieure n'a pas de troisième lobe." But in *Licaphrium* it is only in the development of a "third lobe" on M_3 that the molars differ really markedly from those of *Thoatherium*, so that this does not very strongly oppose relationship to the latter.

On this aggregate of evidence, it seems probable that *Deuterotherium* is most closely related to *Thoatherium* among the Santa Cruz genera, and possible that the relation is rather directly ancestral.[1]

TYPOTHERIA

Interatheriidæ

Cochilius fumensis,[2] new species

TYPE.—Amer. Mus. No. 29551, partial skull and lower jaws with dentition nearly complete. Found by Justino Hernández.

HORIZON AND LOCALITY.—*Pyrotherium* Beds?, west side of the meseta of Cerro del Humo, north of Lago Musters, Chubut, Argentina.

DIAGNOSIS.—Length P^1–M^3, 34 mm. P^{1-2} but little longer than wide. P^1 not distinctly grooved, P^2 ridged and grooved externally, much like P^{3-4}, but without distinct internal sulcus.

[1]Loomis (1914, pp. 30–31) reached the same general conclusion on a review of Ameghino, without additional original material, but he states that the separation of protocone and protoconule occurs also in *Thoatherium* (his "*Thaotherium*"), whereas they are really united in that genus—not a resemblance but one of the few points of contrast.

[2]*Fumus*, smoke, for the locality, Cerro del Humo.

The type was found in a bed of very hard silicified pink tuff, and the only associated fossils were two partial lower jaws of the same species, some molds of *Strophocheilus* sp., and some dubious impressions or concretions. The direct palæontological evidence of its age is thus very incomplete. *Strophocheilus* occurs at all pre-Patagoniano Tertiary horizons. *Cochilius fumensis* is close to *C. volvens* of the *Colpodon* Beds, but on the other hand it is also clearly related to *Archæophylus patrius* of the *Pyrotherium* beds, and it is very possible that *Archæophylus* and *Cochilius* are synonymous. Its age should be either *Pyrotherium* or *Colpodon*. The stratigraphic evidence is also imperfect. The outcrop

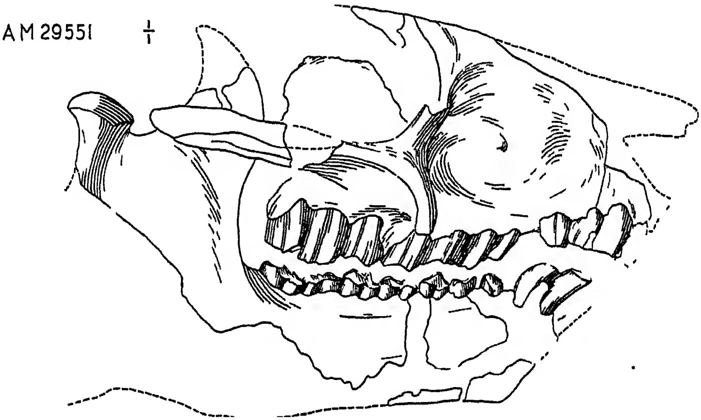


Fig. 2—*Cochilius fumensis*, new species. Type, Amer. Mus. No. 29551. Right lateral view of skull and lower jaw. The posterior part of the mandible median fragment of zygomatic arch, and P_1 are reversed from the other side. Natural size.

Fig. 3—*Cochilius fumensis*, new species. Type, Amer. Mus. No. 29551. Crown view of right upper teeth. Natural size.

is an obscure one in folded and faulted strata. Nearby but in a bed of different character was found a jaw of *Pyrotherium romeroi* and isolated teeth of *Parastrapotherium* sp., definitely indicating *Pyrotherium* age. It appears probable that the present type was at a horizon somewhat higher than these, but in or closely associated with the same series, so that it probably is from the *Pyrotherium* Beds, although the possibility of later age is not wholly excluded.

Ameghino named three genera in the *Pyrotherium* fauna with cheek teeth comparable to those of this specimen, with unreduced dentition,

and incisors rooted and not much enlarged: *Archæophylus*, *Argyrohyrax*, and *Plagiarthrus*. The first he referred to the Protypotheriidæ (=Interatheriidæ), the latter two to the Archæohyracidæ. Loomis separated the genera still farther, removing *Argyrohyrax* to the Eutrachytheridæ. He considered *Plagiarthrus* as possibly representing the lower dentition of that genus, although he placed them in different families.

In this last surmise I think Loomis was almost surely correct. The little that is known of the lower teeth of *Argyrohyrax* is like *Plagiarthrus*. The type species, *A. proavus* and *P. clivus*, appear to be of almost exactly the same size and perfectly harmonious in character. They are probably synonymous, and *Plagiarthrus*, the older name, may be retained in lieu of *Argyrohyrax*. This genus seems to be closer to the Interatheriidæ than to the Archæohyracidæ or Eutrachytheridæ, although the distinctions between these families are by no means so clear-cut as one might wish or as Ameghino and Loomis suggested. Ameghino's figure does not give a wholly adequate impression of the lower teeth of *Plagiarthrus*, and in fact they are hardly distinguishable from those of *Cochilius*, an undoubted interatheriid. Loomis placed the upper teeth, "*Argyrohyrax*," in the Eutrachytheridæ because of the bifid internal fold, but in *Cochilius* the fold is bifid in young individuals in just the same way and to about the same degree. These upper teeth differ much more from *Eutrachytherus* than they do from *Cochilius*. The only marked distinctions from the latter are the apparently lower crowns of I^1-C, their stronger internal cingula, and the possible presence of internal enamel. None of these observations is of clear significance and they may even be in part erroneous. In short, it appears that *Plagiarthrus* should be retained tentatively as a genus, but placed in the Interatheriidæ.

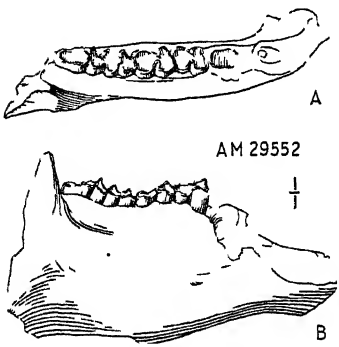


Fig. 4—*Cochilius fumensis*, new species. Topotype, Amer. Mus. No. 29552. Right lower jaw with P_4-M_3. A, Crown view. B, Side view. Natural size.

Archæophylus, based on a palate and unfigured lower jaw, is likewise of dubious status. It is clearly an interatheriid and both Ameghino and Loomis so placed it. The genotype is considerably smaller than any other *Pyrotherium* and *Colpodon* Beds species referred to this family. The only possibly generic distinction from *Cochilius* given by the avail-

able data is the supposedly rooted premolars. In view of the difficulty of distinguishing milk teeth in this family and of the fact that at least $P\frac{1}{1}$ and perhaps also $P\frac{2}{2}$ appear to be rooted in *Cochilius*, this supposed distinction is of uncertain value. The genera may be retained as separate tentatively, pending better knowledge of *Archæophylus*.

Fig. 5—*Argyrohyrax proavus* Ameghino. Type. Left upper teeth. Crown view. Natural size. Photograph by Professor W. B. Scott. (The number refers to the negative and is not a catalogue number.)

Fig. 6—*Plagiarthrus clivus* Ameghino. Type. Right lower jaw. Crown and side views. About natural size. Photograph by Professor W. B. Scott.

The present species differs from *Plagiarthrus* (*"Argyrohyrax"*), if that be a valid genus, in the higher I^1-C, without lingual enamel (at least where worn), and from *Archæophylus*, if that be valid, in the rootless P_{3-4}. These are resemblances to *Cochilius*. It differs from most or

some specimens of *Cochilius* in characters surely or probably due to age, such as the non-bifid internal sulcus of the upper molars, failure of anteroexternal groove of upper premolars to penetrate the crown, and absence of posterointernal sulcus on the lower molars. In the first it resembles *Archæophylus*, in the last two *Plagiarthrus*, but I do not believe that these characters have taxonomic value in this case—all may be seen in aged specimens of *Cochilius*. It likewise differs from *Cochilius volvens* in the shorter, wider $P\frac{2}{2}$, but this I take to be a specific character.

In general, the dentition, the facial part of the skull, orbit, and zygoma are remarkably close to *Cochilius volvens*, and whatever the final status of *Archæophylus* and *Plagiarthrus*, the species may best be placed in *Cochilius*.

MEASUREMENTS:—
P^1–M^3—34 mm.
M^1–M^3—15.5 mm.
P_1–M_3—34 mm.
M_1–M_3—16.5 mm.

TOXODONTA

Rhynchippidæ

Rhynchippus pumilus Ameghino, 1897

Ameghino (1897, p. 464) described and figured a fine skull of this interesting species, and Loomis (1914, p. 95) described and figured skull, jaws, and much of the skeleton of *Rhynchippus equinus*. All previous descriptions of the upper dentition of the genus, however, have been based on deeply worn teeth, so that their true pattern has been unknown.

Amer. Mus. No. 29555, collected by me in the *Pyrotherium* Beds of Cabeza Blanca, Chubut, is a skull referable to this species. The greater part of the skull itself is present, and some interesting features, especially in the auditory region, are visible, but it is badly broken and crushed and these details can be treated more lucidly by broader comparisons beyond the scope of this paper. The dentition is very well shown, is of unusual interest, and will be described here.

The teeth are in almost ideal stages of wear to reveal all their characters. I^1 is well worn but still pitted, I^2 moderately worn, with pattern still clear, and I^3 unworn. The canines are missing. P^1 is formed, but dm^1 is still in place below it. P^{2-3} are slightly worn, with apical pattern still clearly visible, and P^4 has cut the gum but is unworn. M^{1-2} are functioning, with apical cusps all worn off but none of the pits obliterated, the pulp cavities nearly closed and permanent roots forming

M^3 is just about to cut the gum, quite unworn, the pulp cavity widely open and the crown not yet fully formed.

Loomis distinguishes this family as brachyodont, but I think the term inapplicable. The molar crowns are more than twice as deep as their greatest anteroposterior diameter and do not form closed roots until after their eruption. They are distinctly hypsodont, although not of continuous growth.

I^1 and I^2 are both very hypsodont and strongly curved, subequal in size. I^3 is somewhat smaller and with a lower crown. Each has a well

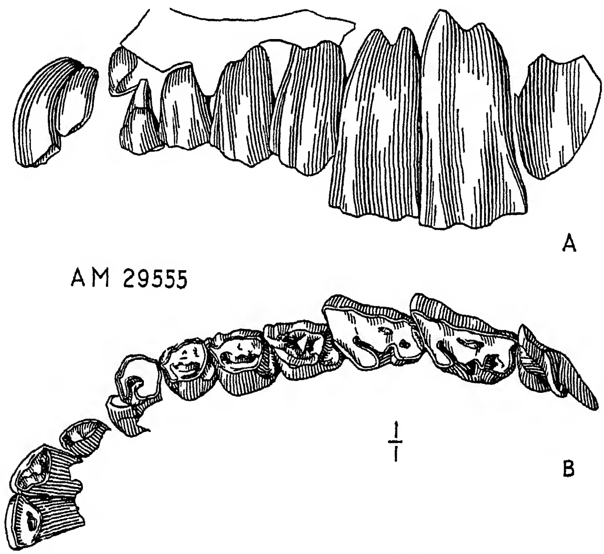


Fig. 7—*Rhynchippus pumilus* Ameghino. Amer. Mus. No. 29555. Left upper teeth. A, Side view. B, Crown view. Natural size.

marked but rather shallow apical pit which on I^2 and still more distinctly on I^3 tends to open through a narrow notch at the lateral or posterior (proximal) edge. At least on I^{2-3} there is a small rounded ridge within the pit, fully united with the middle of the external crest. On I^2 it is short, simple, and ends freely in the pit. On I^3 it is a more formless low rounded eminence filling most of the bottom of the pit. P^1, not fully visible on our specimen, seems to resemble I^3. dm^1 has a much lower and nearly circular crown with a central pit.

P^{2-4} are of closely similar structure, progressively increasing in size and in relative height of crown. At first, length exceeds width, but with

increasing wear these dimensions would become nearly equal. The ectoloph is marked by a sharp anteroexternal vertical groove, separating parastyle and paracone ridges, as well as a less marked posteroexternal ridge. The apex, when unworn, is marked by three pits or fossettes, separated by crests. The longest and deepest occupies the inner side and extends anteroexternally, where in the earliest wear stages it is open through a shallow notch in the protoloph. The other two are small, shallow, nearly circular, about equal, and adjacent, one near the middle of the external moiety, the other just posterior to it. There are no distinct external, anterior, or internal cingula, but there is a strong basined posterior cingulum with a shallow posterointernal pit, becoming a coronal fossette with advanced wear, after the disappearance of the two minor external fossettes. P^4 is not molariform, and the transition to the molars is abrupt.

In dealing with the molar structure, a comparative review is most instructive. The majority of the *Pyrotherium* and *Colpodon* Beds

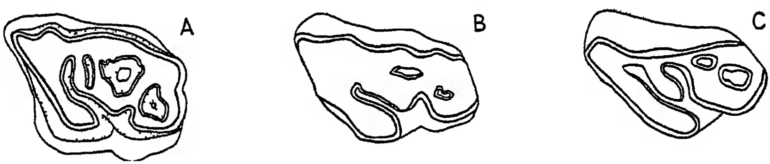


Fig. 8—Left upper molars of three early toxodont families in approximately equivalent wear stages. A, Notohippidæ (*Argyrohippus*). B, Rhynchippidæ (*Rhynchippus*). C, Nesodontidæ (*Nesodon*). Not to scale.

toxodonts (*sensu stricto*), with the exception of the Leontiniidæ, may be placed in three families, Rhynchippidæ, Notohippidæ, and Nesodontidæ. Each of these proves to have a characteristic molar pattern usually readily recognizable from unworn or moderately worn teeth. All are hypsodont, in degree depending rather on the age than on phyletic differences, but with closed roots. The Notohippidæ, but not the other two families, early developed a heavy cement coating on the cheek teeth.

In the Nesodontidæ, exemplified by *Proadinotherium* of the *Pyrotherium* and *Colpodon* Beds and by *Nesodon* of the Santa Cruz Formation, the molar pattern may be described as formed by a strong continuous ectoloph with five crests of different size and relation extending inward from it. The most anterior and distinct, clearly a true protoloph, extends to the internal border, where it ends freely until the very last stages of wear. The next, which may for descriptive purposes be called the first crista, reaches only to about the middle of the tooth, where it also ends

freely almost throughout its depth. The large anterior valley is thus open on the internal side almost throughout all wear stages, and is bifid at the outer end, its two branches resembling the prefossette and medifossette of the rhinoceros molar, for example, although not actually becoming closed fossettes even with advanced wear. The next two crests become united high on the crown at about the middle of the tooth, and the continuation inward from this point may be simple or may be unequally bifid at the internal side. A pit or fossette, closed even in early wear stages, is thus formed between these crests on the outer part of the tooth. For descriptive purposes, in spite of some question as to actual homology, the more anterior of these crests, where they are double, may be called the second crista, and the more posterior and the common inner part the metaloph. The fifth, and most posterior crest appears to arise phylogenetically as a cingulum. It extends from the ectoloph to the inner border, where it is united at a high point with the metaloph (except usually on M^3), enclosing another posterointernal or median posterior fossette, which seems to correspond rather closely with the perissodactyl postfossette.[1]

In the middle wear stages in the Nesodontidæ there are thus typically an anterior valley, open on the inner side and bifid externally, and two closed fossettes posterior to this.

The pattern in the Notohippidæ is typically closely similar to this, except that the first crista is united with the second crista nearly but not quite to its apex, at its inner end. In middle wear stages in this family, there are thus an anterior valley, similar to that in nesodonts but not bifid, and three closed fossettes external and posterior to this. The difference in itself is not very important, and the two conditions appear to intergrade to some extent, but it is fairly constant and characteristic of the two families.

In the Rhynchippidæ, as could not be seen on specimens known previously, the structure is more radically distinct from that of the Nesodontidæ. Protoloph and (nominal) metaloph and postfossette are much as in the two preceding families, but there is only one crista. This extends nearly to the inner border on apex of the unworn tooth, but retreats to near the middle of the crown as it continues toward the roots, as if crowded externally by the drawing together, and eventual fusion, in this direction of the inner ends of the protoloph and metaloph. Near the middle of the crown (considered transversely) and nearly to the apex,

[1]As they arose quite independently, the word "homologous" seems to me inapplicable even where the same topographic nomenclature is conveniently used in such cases

this crista is united to the metaloph, so as to enclose a single median external fossette. When moderately worn, the rhynchippid molar thus has an oblique main anterior valley, open at the inner border and not bifid at its anteroexternal end, and two small relatively shallow, closed fossettes, one median external and the other median posterior or postero-internal. With advanced wear the small fossettes disappear, the valley becomes closed on the inner side and is thus itself converted into a closed, long, narrow, curving pit or fossette. This is the condition figured by Loomis in *R. equinus*, while in Ameghino's figure of *R. pumilus* the condition is nearly the same except that the internal opening of the valley has not quite closed on the grinding surface of M^{2-3}. In this stage it gives little hint of the more complex apical pattern.

There are several ways in which the notohippid and nesodont pattern could be derived from the rhynchippid, but the reality of any one cannot be demonstrated without fuller phylogenetic data than that yet presented. That the three groups are rather intimately related and that the rhynchippids are on the whole the most primitive, are tenable working hypotheses.

Notohippidæ

Argyrohippus frateroulus Ameghino, 1902

The type of this genus does not appear to have been designated, the two species *A. boulei* and *A. fraterculus* being included in the original publication. There are obvious lapses or misprints in the measurements given, and the distinctions are not clear, so that the status of the species

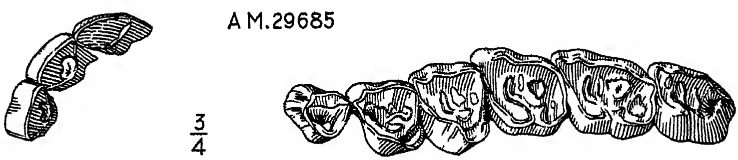


Fig. 9—*Argyrohippus fraterculus* Ameghino. Amer. Mus. No. 29685. Crown view of left upper teeth. Three-fourths natural size.

and the identification of other specimens is still uncertain. To assist stabilization, I now designate *A. fraterculus* as genotype. Although placed after *A. boulei* in the original description, it was clearly considered by Ameghino to be the more characteristic, as it was this species, and not *A. boulei*, to which he several times referred in later publications and which he later figured.

Amer. Mus. No. 29685, found by C. S. Williams in the *Colpodon* Beds south of Lago Culhué-Huapí, clearly belongs in this genus and probably in this species. It is a skull, lacking the posterior part of the cranium but with the teeth well preserved. The dentition will not be described in detail at this time, but is figured. The essential molar characters, as mentioned above, are the heavy cement and the presence of two cristæ united nearly to their apices. The family appears to represent a valid phylum, of rather close common origin with the nesodontids.

REFERENCES

Ameghino, F. 1897. Mammifères crétacés de l'Argentine. (Deuxième contribution à la connaissance de la faune mammalogique des couches à *Pyrotherium*). Bol. Inst. Geog. Arg., XVIII, pp. 406–429, 431–521. [Also as a separate, pp. 1–117.]

1902. Première contribution à la connaissance de la faune mammalogique des couches à *Colpodon*. Bol. Ac. Nac. Ci. Córdoba, XVII, pp. 71–138.

Loomis, F. B. 1914. The Deseado Formation of Patagonia. Amherst, Mass.

Scott, W. B. 1910. Litopterna of the Santa Cruz Beds. Rept. Princeton Exp. Patagonia, VII, Pt. I, pp. 1–156.

AMERICAN MUSEUM NOVITATES

Number 577 | Published by The American Museum of Natural History New York City | Nov. 4, 1932

56.9, 71 C (1181:82.9)

COCHILIUS VOLVENS FROM THE *COLPODON* BEDS OF PATAGONIA[1]

By George Gaylord Simpson

In the collection made by the Scarritt Patagonian Expedition in the *Colpodon* Beds south of Lago Colhué-Huapí are a number of fine specimens of *Cochilius volvens* revealing all of the skull and dentition and part of the skeleton. This genus is a very interesting one and has never been figured or described in any detail.

In the present paper its anatomy is illustrated and briefly described and its affinities discussed. The drawings are by John C. Germann.

MATERIAL

The principal specimens here considered are listed below. All are from the same locality, that south of Colhué-Huapí whence came Ameghino's best specimens of this fauna, and within a few feet of the same horizon. Although somewhat variable, all these specimens are referred to *Cochilius volvens*. Ameghino named two other species, both poorly known and both larger than any of these specimens.

Amer. Mus. No. 29651, complete, well preserved skull with dentition complete except I^{2-3} right and I^3–C left.

Amer. Mus. No. 29686, lower jaw with partial dentition, right humerus, radius, ulna, and part of manus, many vertebræ and ribs.

Amer. Mus. No. 29652, lower jaw nearly complete, with right P_2–M_3 and left I_{2-3}, P_1–M_3.

Amer. Mus. No. 29653, left lower jaw with P_1–M_3.

Amer. Mus. No. 29658, right lower jaw with I_1–C, P_2–M_3.

Amer. Mus. No. 29654, right lower jaw with I_1–C, P_3–M_3, and left I_1.

Amer. Mus. No. 29655, part of rostrum and palate with right I^1–M^1 and left I^{1-2}.

Amer. Mus. No. 29657, part of right maxilla with P^1 or dm^1, unerupted P^{2-3}, dm^4, and M^{1-3}.

MORPHOLOGY

Cochilius will be described chiefly by comparison with its closest relatives in the Santa Cruz, *Protypotherium* and *Interatherium*, both already well described by Sinclair.

Dentition.—The median upper incisors are quite as much enlarged as in *Protypotherium australe*, in some cases even a little more, but have

[1]Publications of the Scarritt Patagonian Expedition, No. 9.

distinctly lower crowns. On all the incisors and also on the canine the enamel is confined to the labial surface in the worn specimens available. These teeth all have closed roots. I^1 is scalpriform, slightly heavier near the midline. I^{2-3} are subequal, smaller than I^1 and similar in form but still more asymmetrical, heavier anteriorly. The three incisors and the canine imbricate, their thinner posterior edges lapping outside the following tooth. The canine is smaller than any of the incisors and similar in form except that it rises to a more definite anterior cusp, perhaps the effect of different and less severe wear. Unlike that of *Protypotherium australe*, it is not grooved externally. There is little or no cement on these anterior teeth. They resemble *Protypotherium* in the absence of diastemata and better development of the lateral incisors and canines than in *Interatherium.*

P^1 is a small tooth, about as long (anteroposteriorly) as the canine but wider transversely, although the length still exceeds the width. The inner face is incompletely enamel-covered, unlike the following teeth which have internal enamel at all stages of wear, or the preceding ones which have it only at the apex if at all. This tooth probably forms a closed root. The molars and posterior premolars have open roots at least until an advanced age and perhaps throughout life, but the exact point of division in the dentition between this and the rooted condition is not established. In the lower jaw P_1 certainly and P_2 probably form closed roots. In the two Santa Cruz genera all the cheek teeth are rootless. P^1 may have the internal face simply convex (Amer. Mus. No. 29655) or with a shallow vertical groove (Amer. Mus. No. 29651), probably an age character. The outer face is flattened and has a small ridge at the anterior angle.

Save for their progressive increase in size, P^{2-4} are closely similar. There is a strong sulcus on the internal face, which shows some tendency to bifurcate. This sulcus divides the face into two nearly equal lobes as in *Interatherium*, whereas in *Protypotherium* the sulcus is generally near the anterior edge and the lobes decidedly unequal. As a result, these teeth are distinctly more molariform in the earlier genus and in *Interatherium*, although this does not necessarily make them more advanced in this respect, as the condition in *Protypotherium* could well be a specialization, or at least there is no warrant for considering it as a retained ancestral structure. The outer faces of P^{2-4} are flattened, with a poorly defined swelling on the posterior two-thirds and two more sharply defined vertical ridges on the anterior third, between which is a narrow groove. In one specimen (No. 29651) this penetrates deeply into the anterior lobe

as a closed enamel fold, but on another (29655) it penetrates much less. It is probable that this is due to degree of wear.

M^{1-3} are similar to P^{2-4} save that the ridging and grooving of the outer wall are less strong. The anterior groove in no case penetrates the crown and may be very faint or apparently absent. M^3 does not have the posterior extension or incipient third lobe seen in some specimens of *Protypotherium*. On all the cheek teeth (save P^1) the sculpturing of the outer wall resembles the latter genus and is much weaker than in *Interatherium*.

I_{1-2} occlude against the large I^1. I_{1-3} are progressively larger and of rather similar form, between styliform and spatulate and distinctly bilobed on the inner surface when little worn. The roots are long but closed; the crowns, completely invested in enamel, are high but less so than in the Santa Cruz genera. The canine is almost identical in form

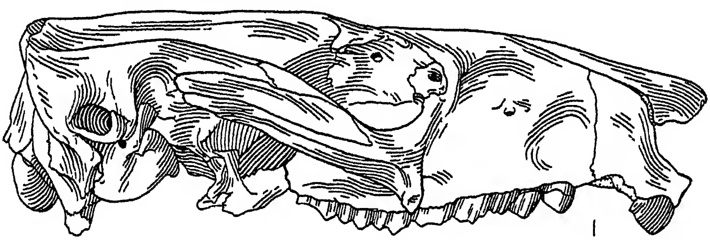


Fig. 1.—*Cochilius volvens* Ameghino. Amer. Mus. No. 29651. Skull, right lateral view. Natural size.

with the incisors but with a very slight posterior basal expansion, and P_1 also differs very little but has a more distinct posterior and slight anterior blade-like extension.

P_2 has much the same form as the following teeth when deeply worn except for its relatively greater length and lesser width, but when unworn, as it is in No. 29652, it shows in a clear and interesting way the origin of this columnar pattern from the basic molar form underlying the whole great notoungulate group. It is lophiodont, divided into trigonid and talonid crescents perfectly united at the metaconid, which is the highest cusp. Within the talonid crescent is the transverse entoconid crest, united nearly to its apex with the middle of the crescentic hypoconid-hypoconulid crest. The external sulcus between the hypoconid and protoconid and the internal sulcus between the entoconid and the metaconid persist on all the teeth throughout life and define the two

prisms of the worn teeth. The anterointernal groove, in the trigonid crescent, disappears rapidly with wear. The postero-internal groove, between the entoconid and the hypoconulid, persists longer and is present as a deep narrow sulcus on some worn premolars, but eventually it, too, disappears and there is no trace of it on any of the molars preserved.

As with the upper premolars, the lower premolars are more molariform in *Cochilius* than in *Protypotherium* and except for P_1 closely resemble those of *Interatherium*. The two prisms are nearly equal on P_{2-4}, or the posterior slightly larger on P_4. In *Protypotherium* the posterior lobe is considerably smaller on all three.

Lower molars and posterior premolars consist of two prisms united by a narrow isthmus internal to the midline. Each lobe is rounded on the

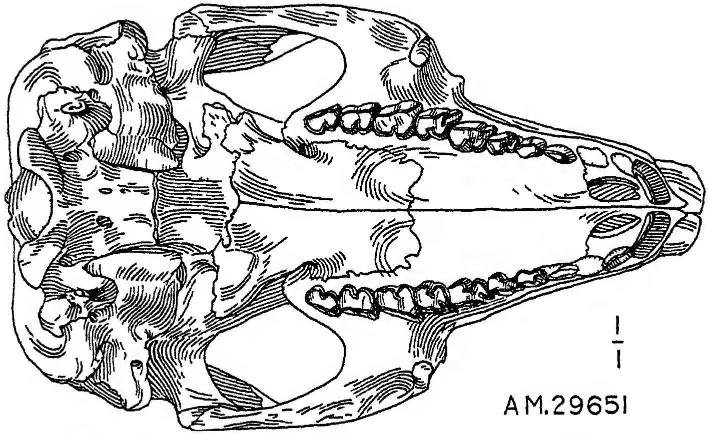


Fig. 2.—*Cochilius volvens* Ameghino. Amer. Mus. No. 29651. Skull, palatal view. Natural size.

outer side and more flattened on the inner. The longer posterior lobe is slightly and evenly convex internally, and the anterior lobe has a small, well-defined posterior vertical crest. The posterior prism of M_3 is elongate, with very shallow external and internal grooves vaguely tending to cut off a third lobe.

Amer. Mus. No. 29657 had the milk teeth still in place, although M^3 is already well worn, such late replacement being common in typotheres. P^1 of this specimen is a rooted tooth already in use but apparently without a successor, so that it is doubtful whether this is really P^1 or dm^1 and whether there was a replacement here. P^{2-3}, not yet erupted, have the grinding surface deeply covered with cement, beneath which is a thin, apparently complete enamel coating.

SKULL.—The premaxilla resembles that of *Interatherium* more than that of *Protypotherium*. It is shorter than in the latter and has no ascending process between the maxilla and the nasal. The suture against the maxilla is a simple vertical line. It reaches the alveolar border at the middle of I^3, but this tooth is wholly implanted in the premaxilla, the posterior part of the alveolus being surrounded by a thin wall from that bone which is mortised into the maxilla. The maxilla is also nearly like that of *Interatherium*. The superior process, set into the frontal above the orbit, is stouter than in *Protypotherium* and a little longer than in *Interatherium*. The descending process below the orbit on the base of the zygoma is much stronger than in *Protypotherium* but slightly shorter

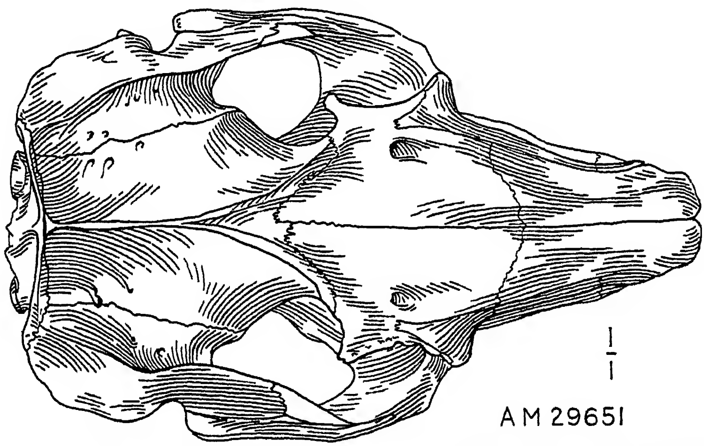


Fig. 3.—*Cochilius volvens* Ameghino. Amer. Mus. No. 29651. Skull, dorsal view. Natural size.

than in *Interatherium*. The facial part differs from that of either of the later genera in having not a single broad concavity, but two, the more anterior one smaller, deeper, and more definite.

The fronto-nasal suture, often highly variable in this family, is an even curve, convex forward. The postorbital processes are well developed, as in *Protypotherium*. The sagittal and lambdoid crests are nearly as in *Interatherium*, differing from *Protypotherium* chiefly in the greater transverse length of the latter, with which is related the lesser divergence of the opposite squamoso-parietal sutures.

The curious zygoma is nearly the same in all three genera, and is essentially formed by maxilla and squamosal. The jugal is a thin splint of bone, excluded from the orbital rim and not appearing on the inner

surface of the zygoma at all except at its posterior end. Here the jugal above and the end of the maxilla below form a vertical wall at the outer side of the glenoid surface.

The occiput has about the proportions of *Interatherium*, broader and lower than in *Protypotherium*, and the paroccipital processes are much shorter and stouter than in the latter genus. The epitympanic sinus is only slightly cancellous, apparently less so than in either of the Santa Cruz genera.

Save for minor differences in variable details of proportions or sutures, the lateral wall of the cranium is constructed as in *Protypotherium* as described by Sinclair. The basicranium is relatively shorter and broader than in *Protypotherium* but in general agreement except that the basioccipital has no keel, that in this apparently fully adult specimen

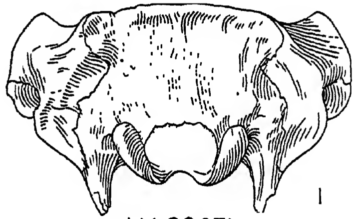


Fig. 4.—*Cochilius volvens* Ameghino. Amer. Mus. No. 29651. Skull, occipital view. Natural size.

all sutures are still open and the bullæ not fused with surrounding elements, and that the basisphenoid is pierced by two prominent vascular foramina.

The posterior margin of the palate is about as in *Protypotherium*, but with the posterolateral notches even more deeply incised.

In its general proportions the skull resembles *Interatherium* in being broad and low and *Protypotherium* in the greater development of the rostrum and median position of the orbits.

The lower jaw differs considerably from *Interatherium* and is very like that of *Protypotherium* but has some features of special interest. As in this whole family and some other typotheres, the angle projects backward well beyond the condyle. The bone is very thin. On the outer side of the base of the coronoid, below and anterior to the condyle, is an indefinitely bounded shallow depression. The insertion of the masseter below this is not really a fossa, but plane or even gently convex. Its lower and posterior margin is sharply marked by a rugose line. Below

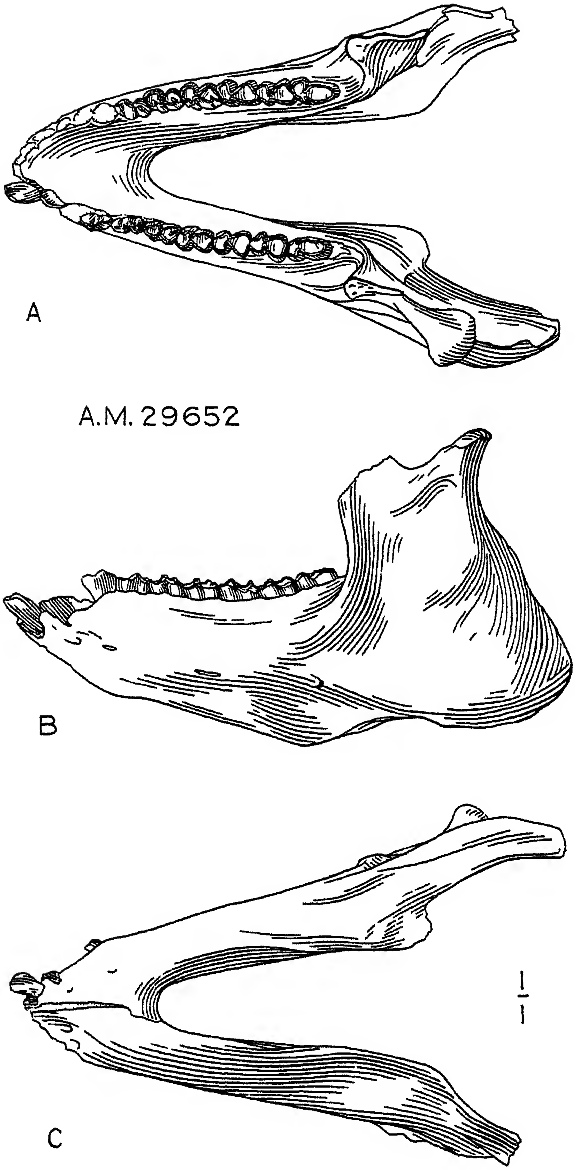


Fig. 5.—*Cochlius volvens* Ameghino. Amer. Mus. No. 29652. Lower jaw. A, Superior view. B, Left lateral view. C, Inferior view. Natural size.

and behind this the thin bony margin is inflected. In this whole family, the inferior margin of the jaw is expanded into a thin flange below the posterior cheek teeth and anterior part of the coronoid. In *Interatherium* this extends straight downward and forms what almost appears to be a second, more anterior angular process which has a homologue or analogue in some other groups, as for instance, in *Urocyon* among canids. In *Protypotherium* the anterior part of this flange is vertical, but the posterior part is somewhat inflected. The condition is almost exactly similar in some specimens of *Cochilius volvens*. On the right side of Amer. Mus. No. 29652, the process is unusually well developed but has this same character. On the left side of the same individual, the posterior part of the inflected flange extends inward and backward in a definite angular process, separated by a notch from the less inflected inferior mandibular border behind it.

In both *Interatherium* and *Protypotherium* a deep groove leads into the dental foramen from above. In both of the two specimens of *Cochilius volvens* that show it completely, this has undergone a striking further development. At a distance of 1.5 to 3 mm. from the dental foramen the groove enters the jaw through a separate foramen, communicating internally with the dental canal. In another specimen the bridge of bone separating the two foramina seems to have been absent, but the specimen is not perfectly preserved and some doubt remains. The character was probably variable.

As in the later genera, there are, with fair constancy, one small posterior mental foramen below or near P_4 and two anterior mental foramina near I_3 and C.

Fore Limb.—The fore limb is very closely similar to that of *Interatherium* except in a few details. It is more slender throughout, even a little more slender than in *Protypotherium*. The humerus is somewhat crushed but probably had as an original feature a narrower trochlea and certainly had a very sharp and prominent inner crest. As in *Interatherium* and strikingly unlike *Protypotherium*, there is no trace of an entepicondylar foramen. The radius and ulna are likewise slender and the sigmoid notch deeper and more constricted than in the Santa Cruz genera, but otherwise in agreement with the latter, as is the carpus. The proximal ends of the metacarpals show less overlap in *Cochilius*. The fifth is slightly shorter relatively than in *Interatherium robustum* and all are much more elongate and slender than in that genus generally.

Parts of at least fourteen vertebræ and some other fragments are also present in Amer. Mus. No. 29686, but they reveal nothing of particular interest.

AFFINITIES

Cochilius is clearly a typothere of the family Interatheriidæ (or Protypotheriidæ). This group is characterized in the dentition by the complete (or nearly complete) dental formula, median upper incisors rooted and only moderately enlarged, lower incisors not enlarged, molars and some or all premolars rootless, upper molars with single internal sulcus simple or weakly bifurcated. The most obvious distinction in the skull is the reduction of the jugal to a thin bone overlying the maxilla and squamosal and lacking much of reaching the lacrymal. The skeleton

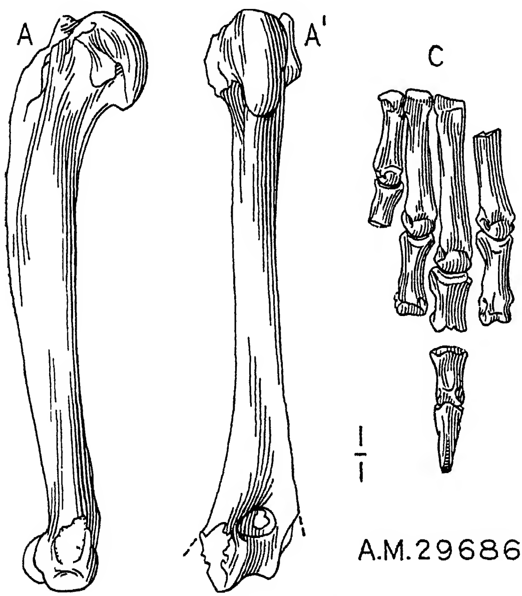


Fig. 6.—*Cochilius volvens* Ameghino. Amer. Mus. No. 29686. A, Right humerus, lateral view. A[1], Same, posterior view. B, Right ulna, lateral view. B[1], Same, anterior view. C, Right manus, dorsal view. Natural size.

is also characteristic, most strikingly so in the pes which is paraxonic, with symmetrical astragalar trochlea, and no naviculo-calcaneal facet. These distinctions, as established by Sinclair, characterize two Santa Cruz genera, *Protypotherium* and *Interatherium*. So far as comparable parts are known, they are also present in *Cochilius* which thus enters into this family.

Its resemblance to the Santa Cruz genera is not confined to primitive characters, the retention of which is one of the outstanding features

of the family, but extends also to various specializations, so that *Cochilius* cannot be very near the exact ancestry of genera placed in any other family.

The family lingered on into the Pliocene, for rather poorly known *Protypotherium*-like forms are found in various late Santa Cruz and post-Santa Cruz deposits, as at Monte Hermoso, but these survivors are not here of special concern.[1] The brachyodont to mesodont typotheres of the *Notostylops* beds are ancestral in a general way but none shows close special resemblance to this family. The *Pyrotherium* Beds to Santa Cruz forms are those of more immediate interest in connection with *Cochilius*. In addition to one or two genera either synonymous or too poorly known to be placed with any assurance, Ameghino named the following genera:

Santa Cruz $\begin{cases} \textit{Protypotherium} \\ \textit{Interatherium} \end{cases}$

Colpodon Beds—*Cochilius*

Pyrotherium Beds $\begin{cases} \textit{Archæophylus} \\ \textit{Plagiarthrus} \ (+\textit{Argyrohyrax}) \end{cases}$

These are all very closely related, but do not represent a single progressive phylum.

The distinction between *Archæophylus* and *Cochilius* is by no means clear. In defining *Archæophylus*, Ameghino gave numerous characters, many of family value and not distinguishing the genera from any other of the four listed, others clearly of not more than specific value. The only character given by him which appears to me of possible generic value is the supposedly rooted character of all the premolars. In *Cochilius*, at least $P\frac{3-4}{3-4}$ seem to be rootless and in the Santa Cruz all the premolars are of continuous growth. This observation requires confirmation, as the deciduous molars persist well after the animal is adult and are very difficult to distinguish from permanent teeth.[2] *Archæophylus* is certainly very close to *Cochilius*, and perhaps synonymous. I have elsewhere (Simpson, 1932, p. 4) described another species probably from the *Pyrotherium* beds, *Cochilius fumensis*, that appears to be very close to the later genus in every respect and must be referred to it. If the genera are synonymous, *Archæophylus* has priority, but they may both be retained until *Archæophylus* is better known.

---

[1]In fact, the genotype of *Protypotherium* is from the Entrerian. Kraglievich (1931) has recently described from the same beds a new genus, *Muñizia*, with *Protypotherium*-like teeth and *Pachyrukos*-like jugal and orbit. If the fragmentary specimen is correctly interpreted, derivation of this genus from one with a *Protypotherium*-like jugal would demand a reversion so extraordinary that I cannot

...ng from *Interatherium* in having pr... molars of persistent rather than limited growth. Sinclair has shown that *Interatherium*, the older name, was based on specimens with milk teeth.

As has been explained in a previous paper (Simpson, 1932, p. 6), I believe *Plagiarthrus* and *Argyrohyrax* of the *Pyrotherium* Beds to be synonymous and to belong to this family. The lower jaw, type of *Plagiarthrus clivus*, reveals no good generic distinction from *Cochilius*, but it lacks the anterior teeth. The upper dentition, type of *Argyrohyrax proavus*, has very *Cochilius*-like cheek teeth but has I^1–C lower-crowned, with internal cingula, and apparently with lingual enamel. Ameghino placed both those supposed genera in the Archæohyracidæ. Loomis suggested that they might be synonymous, but separated them widely by removing *Argyrohyrax* to the Eutrachytheridæ. In fact both upper and lower teeth are much more like *Cochilius* than they are like either *Archæohyrax* or *Eutrachytherus*. Its more detailed relationships are not clear. If I^1–C are not milk teeth, the genus is distinct and not ancestral to *Cochilius*.

It should be clear from the description above that *Cochilius* is not ancestral to either *Protypotherium* or *Interatherium*, in spite of its close resemblance to both. It has few characters that are not seen in one or the other of the later genera, but such eclectic union of characters confined to one or the other that it can hardly be directly ancestral to either. In the dentition, the lower-crowned anterior teeth and rooted anterior premolars are doubtless primitive. The closed tooth row and unreduced I^2–C are also primitive as well as special resemblances to *Protypotherium*. The median incisors may be somewhat more enlarged than in either, although the difference is slight and variable. The incipient bifurcation of the internal sulcus is also an aberrant character apparently absent in the later genera. The cheek teeth, upper and lower, are otherwise closer to *Interatherium* except that the outer wall of the uppers more resembles *Protypotherium* in the weaker sculpture.

A similar mingling of characters, both primitive and specialized, present in the later genera but not common to both, is seen in the other known parts. On the whole the skull is like that of *Interatherium*, and the lower jaw like that of *Protypotherium*, yet in the placing of the orbit, development of the rostrum, and some other characters the skull is more *Protypotherium*-like. Aside from its slender proportions, the fore limb in general is more like that of *Interatherium* so far as distinctive, especially in the absence of the entepicondylar foramen.

Many of the differences from *Interatherium* and resemblances to *Protypotherium* are primitive characters, and specialized characters tend to indicate the opposite relationship. On this basis, definitely closer affinity with *Interatherium* is indicated. *Protypotherium* is a generally

conservative genus whose ancestry must have diverged from that of *Cochilius* some time before the *Colpodon* Beds were deposited. *Interatherium* is definitely more specialized than *Cochilius*, not directly descended from *C. volvens*, but probably of close common ancestry.

NOTE ON *ARGYROLAGUS*

The genus *Argyrolagus* was described by Ameghino on the basis of a partial lower jaw and considered by him as the last and only known representative of a family of rodents which gave rise to all duplicidentates. Kraglievich (1931) recently redescribed the specimen and opposed its reference to the Rodentia but reached a conclusion still more extraordinary. He believed it to be a marsupial and a true diprotodont, as opposed to the paucituberculates or cænolestoids of South America. He concluded that this implies a connection, direct or indirect, with Australia probably no earlier than the Miocene.

This hinges on the real affinities of *Argyrolagus*. If it is marsupial, then Kraglievich is right in considering it to represent a very distinctive and diprotodont-like family and either, as he supposed, a real diprotodont in a systematic sense or a remarkably convergent type. If it is not marsupial, then the resemblance to the diprotodonts obviously has no more significance than, for instance, the equally marked resemblance of *Pyrotherium* to *Diprotodon*.

The evidence that *Argyrolagus* is a marsupial is essentially the presence of just four molariform teeth, the apparently inflected angle, and the general conformation of the region around and below the base of the coronoid process.

Neither Ameghino nor Kraglievich seems to have considered a third possibility, which is, I believe, the true interpretation of *Argyrolagus:* that it is an aberrant typothere. The presence of four molariform teeth is not remarkable, since most South American ungulates, including the typothere, had long since acquired molariform posterior premolars. The rodent-like incisor and the reduction of the intermediate teeth represent the further development of tendencies often displayed in the Typotheria. The details of *Argyrolagus* in this respect make it a fully distinctive genus of an aberrant phylum, but are not otherwise remarkable for a typothere. The actual shape of the molars, again not exactly like any other typothere genus, is likewise clearly within the potentialities of the group. The molar form is distinctly more typothere-like than it is like any known marsupial.

If some specimens of *Cochilius* were broken in just the same way as is the type of *Argyrolagus palmeri*, they would show an apparently in-

flected angular process and otherwise be just as marsupial-like in this region as is *Argyrolagus*. This fact seems to remove any possible basis for using these characters as evidence of marsupial affinities and to support the other evidence that the genus is an aberrant typothere.

Finally, interesting as it is, there is nothing extraordinary or contrary to other phylogenetic, faunal, and palæogeographic evidence in the development of such a form among the native South American Typotheria, while the presence of a marsupial with these characters at this time and in this place would be so contrary to the probabilities established on such evidence that it could not reasonably be maintained except in the presence of positive proof and in the absence of any acceptable alternative.

The broader, palæogeographic, aspects of Kraglievich's note cannot be discussed at length here, except to point out that it seems beyond question that South America has had no connection with Australia (or with Africa)[1] at least since the Paleocene. There is considerable evidence both for and against an earlier connection, in the Cretaceous or Paleocene, with Australia and, or, Africa, a question not yet susceptible of positive proof one way or another, although I believe the probabilities to be against the reality of either bridge as a migratory route for mammals. But even if these bridges ever did exist, that they disappeared long before the Miocene is as nearly proven as a negative statement can be.

REFERENCES

AMEGHINO, F. 1897. Mammifères crétacés de l'Argentine. (Deuxième contribution à la connaissance de la faune mammalogique des couches à *Pyrotherium*). Bol. Inst. Geog. Arg., XVIII, pp. 406–429, 431–531. [*Archæophylus*.]

1902. Première contribution à la connaissance de la faune mammalogique des couches à *Colpodon*. Bol. Acad. Nac. Ci. Córdoba, XVII, pp. 71–138. [*Cochilius*.]

KRAGLIEVICH, L. 1931. Cuatro notas paleontológicas. (Sobre "*Octomylodon aversus*" Amegh., "*Argyrolagus Palmeri*" Amegh., "*Tetrastylus montanus*" Amegh., y "*Muñizia paranensis*" n. gen., n. sp.). Physis, X, pp. 242–266.

LOOMIS, F. B. 1914. The Deseado Formation of Patagonia. Amherst, Mass.

SIMPSON, G. G. 1932. New or Little-known Ungulates from the *Pyrotherium* and *Colpodon* Beds of Patagonia. Amer. Mus. Novitates, No. 576.

SINCLAIR, W. J. 1909. Typotheria of the Santa Cruz Beds. Repts. Princeton Univ. Exp. Patagonia, VI, pp. 1–110.

[1]Stromer has recently described under the name *Palæothentoides* a supposed cænolestid from the Pliocene of Africa, but its resemblances to the cænolestids are not very close and even its marsupial affinities are still open to some question. It might be an aberrant insectivore, and more material, showing at least the upper teeth, is essential before the occurrence can be considered more than suggestive.

AMERICAN MUSEUM NOVITATES

Number 578 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Nov. 4, 1932

56.9: 14.71, 5

SKULLS AND BRAINS OF SOME MAMMALS FROM THE *NOTOSTYLOPS* BEDS OF PATAGONIA[1]

BY GEORGE GAYLORD SIMPSON

Mammals of the *Notostylops* Beds, the earliest mammals yet described from South America, are very poorly known, and the literature, aside from the publications of Ameghino, generally either neglects them or is very uncomprehending concerning them. This is due to several causes: the fragmentary nature of most of the known specimens, neglect or distrust of Ameghino's work, and the fact that this work was in large part of a preliminary nature and inadequately illustrated. This last point could not well be appreciated without revision of the Ameghino Collection, which proves to contain a number of fine specimens which have been illustrated only in part or not at all. In advance of fuller revision, it therefore may be of interest to publish a few sketches of the skulls of the best known species in that collection. These will later be augmented by drawings of skulls of several other species found by the Scarritt Patagonian Expedition. Of the four genera here illustrated, there are previous figures of the skull of only one, *Notostylops*. It is also now possible to give figures of partial endocranial casts of *Notostylops* and of *Oldfieldthomasia*.

I am much indebted to the authorities of the Museo Nacional de Historia Natural of Buenos Aires, and particularly to the director, Dr. M. Doello-Jurado, and also to Sr. Carlos Ameghino for the privilege of studying this material. The restoration (but not the skull) of *Notopithecus* was drawn by Louise Germann, the endocranial cast of *Oldfieldthomasia* by Mildred Clemans, and the other illustrations by me. In these drawings an attempt has been made to correct distortion, and they are in part composite, as noted in the text, but the parts in continuous lines are carefully delineated from actual specimens and are not diagrammatic or conjectural.

THE SKULL OF **Arminiheringia**

Arminiheringia auceta is the most completely known pre-Santa Cruz "sparassodont" or borhyænid, but it has not been figured, and Ameghino's brief description did not lead to recognition of its peculiar

[1]Publications of the Scarritt Patagonian Expedition, No. 10.

character. It therefore seems worth while to illustrate the species in this preliminary note, even though the cranial part of the skull is not known. The originals are the types, Museo Nacional Nos. 10972 and 10970, face and lower jaws respectively, found separated in the Ameghino Collection but both included in the original description and, on this and also independent evidence, almost surely of one individual. In the figure some distortion has been corrected but nothing has been added.

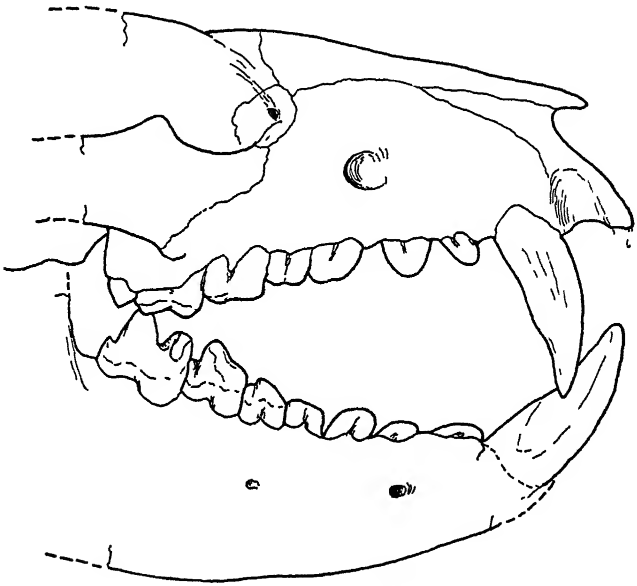


Fig. 1.—*Arminiheringia auceta* Ameghino. Museo Nacional No. 10972 (skull) and No. 10970 (jaws). Front part of skull and jaws, right lateral view. One-half natural size.

The presence of this great specialized carnivorous marsupial in the *Notostylops* Beds is very remarkable and unexpected. With the exception of a much later and amazingly aberrant genus found by Riggs in Catamarca, *Arminiheringia* appears to be the most specialized known borhyænid. It is a large animal, a third larger than *Borhyæna tuberata* and about the size of the great *Pharsophorus lacerans*.

The face is much like that of other large borhyænids, e.g., *Borhyæna* itself, but is somewhat more elongate, a feature reflected in the long posterior projection of the premaxilla. The naso-lacrymal contact, typical of the family, is already established. The mandible is extra-

ordinary for its long, almost cylindrical and horizontal symphysis, extending back to the posterior end of M_1. Aside from being of the most specialized type, as seen also in *Borhyæna*, with strongly reduced protocone, no metaconid, and talonid reduced to a small cingulum-like heel, the molars are not very distinctive. In keeping with the long rostrum, the premolars are well spaced. Most remarkable are the canines. The upper canines are large and slightly procumbent rather than recurved. The lower canines still larger and strongly procumbent, shearing between the upper canines and at nearly a right angle to them at the beginning of the bite. The root extends very far back, at least to M_1, and those of the

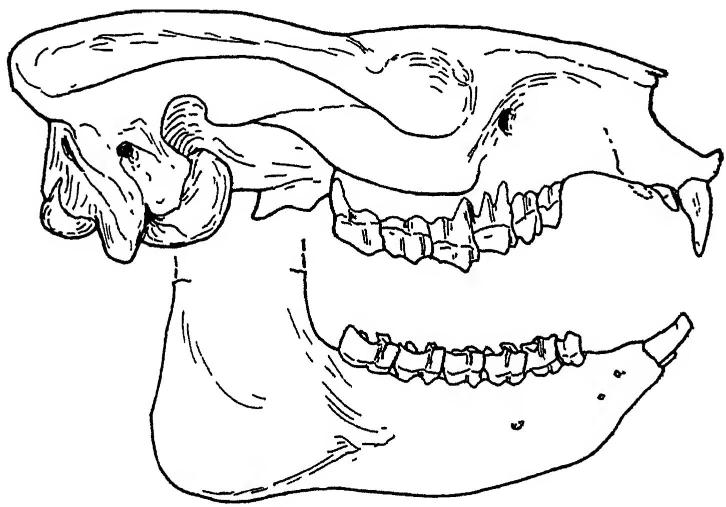


Fig. 2.—*Notostylops brachycephalus* Ameghino. Museo Nacional No. 10499 (skull only). Lower jaw composite. Skull and jaws, right lateral view. Two-thirds natural size.

two canines are closely appressed anteriorly, almost in contact. The crowns diverge somewhat, but crowd the two pairs of small lower incisors so that the first pair is anterior to and not between the second.

The presence of so large and specialized a borhyænid in so ancient a fauna bespeaks a great antiquity for the group. This, however, might be overemphasized. Although distinctly more specialized than even the known Santa Cruz forms, it is not greatly so and is orthodox, that is, presents no wholly unique or profoundly different characters of kind but only modifications of degree. It is also to be noted that these beds do contain borhyænids distinctly more primitive than any known later

forms. *Arminiheringia* is an early, markedly but somewhat superficially specialized offshoot. Analogous cases are abundant in the ancient North American faunas, e.g., *Triisodon* among carnivores or *Periptychus* among ungulates.

The Skull of **Notostylops**

The skull of *Notostylops* has been figured by Ameghino,[1] a dorsal view of a poor skull and palatal view of an excellent one, as well as views of a good lower jaw. Patterson[2] has given ventral and lateral views of the otic region.

The present figure shows the lateral view of Ameghino's fine skull, type of *Notostylops brachycephalus*, Museo Nacional No. 10499, which is unique in being not only nearly complete, but also nearly uncrushed. The mandible shown is a composite of several jaws of this or very closely related species.

Perhaps because of its fame as godfather of this early fauna, *Notostylops* is frequently considered an unspecialized notoungulate and stressed in general discussions of notoungulate origin. It is primitive in many respects, but it is not generalized. On the contrary, it is one of the most especially adaptive forms of the fauna. The habitus is somewhat more rodent-like than ungulate-like, and it probably occupied more or less the ecological status of the larger rodents (rodents being absent in the fauna), as the cænolestids and polydolopids did of the smaller.

As opposed to a generalized notoungulate structure, the skull of *Notostylops* is especially characterized by its short, high rostrum and long, wide, powerful cranium and zygomata. In spite of the development of diastemata, the rostrum is short and the orbit is anterior to the middle of the skull, rather than median or slightly posterior. The anterior root of the zygoma is opposite P^4 and M^1, rather than M^{2-3} which is the primitive position. The zygomata are well expanded and powerful, and sagittal and lambdoid crests well developed.

The lower jaw is not distinctly rodent-like, the parallel axes of horizontal ramus and tooth-row, elevated condyle, and broad flat angle being more ungulate-like.

---

[1]Ameghino, F. 1897. Mammifères crétacés de l'Argentine. Deuxième contribution à la connaissance de la faune mammalogique des couches à *Pyrotherium*. Bol. Inst. Geog. Argentino, XVIII, pp. 406–429, 431–521. [Fig. 68, dorsal view, partial skull of *Notostylops murinus*. Figs. 69–70, crown and lateral views of good lower jaws placed in same species.]

1906. Les formations sédimentaires du Crétacé Supérieur et du Tertiaire de la Patagonie. An. Mus. Nac. Buenos Aires, XV [(3) VIII], pp. 1–568. [Fig. 179, palatal view of skull of *Notostylops brachycephalus*.]

[2]Patterson, B. 1932. The auditory region of the Toxodontia. Field Mus. Nat. Hist., Pub. 305, Geol. Ser., VI, No. 1, pp. 1–27. [Fig. 2, referred to *Notostylops aspectans*.]

One pair of incisors, $I\frac{1}{2}$, is enlarged in each jaw, but still not fully rodent-like. They form roots, and the lower incisor works against the upper so that they are nearly at right angles, and the former is truncated almost transversely, not developing a chisel-edge. The other incisors, canine, and first premolars are always reduced in size and of simple

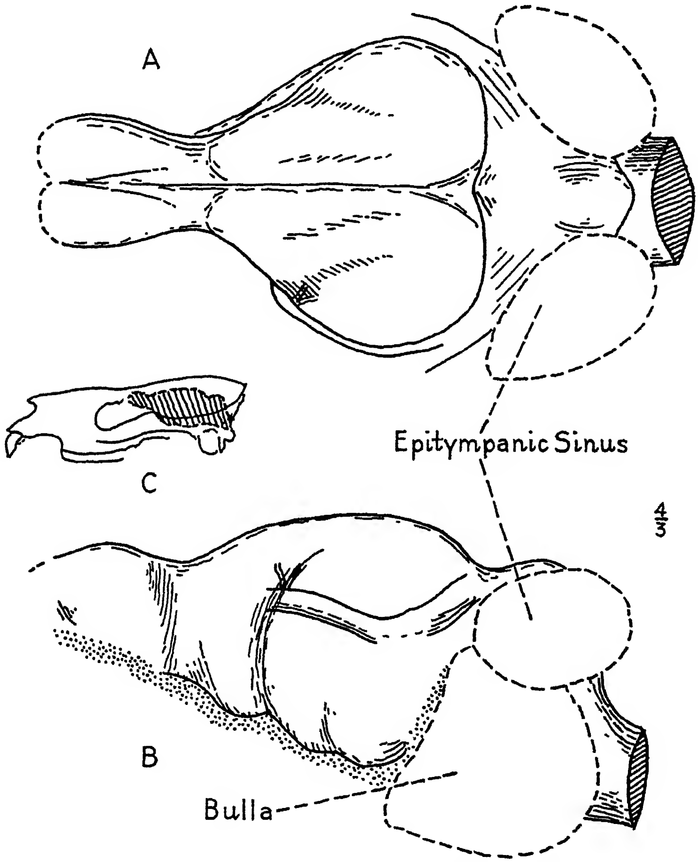


Fig. 3.—*Notostylops escaridus* Ameghino. Museo Nacional No. 10506. A, Endocranial cast, dorsal view. B, Same, left lateral view. C, Diagram of skull and brain cavity. A and B, four-thirds natural size. C, two-ninths natural size.

form, but the numerical reduction is highly variable, a variation which I believe to be largely individual although probably as a tendency it is in part taxonomic. In the individual illustrated, for instance, the upper canine was present on one side and not on the other. The cheek teeth

have crowns of moderate height, but they are remarkable in having shallow coronal patterns, so that the upper molars rapidly become worn in such a way that they present only a concave dentine surface surrounded by a simple enamel border. This rapid disappearance of the coronal folds and lophs would appear to be disadvantageous, especially in an animal which seems to have fed on very abrasive vegetable substances. Perhaps this had an influence on the early extinction of the family and its ecological replacement by others which rapidly became efficiently hypsodont.

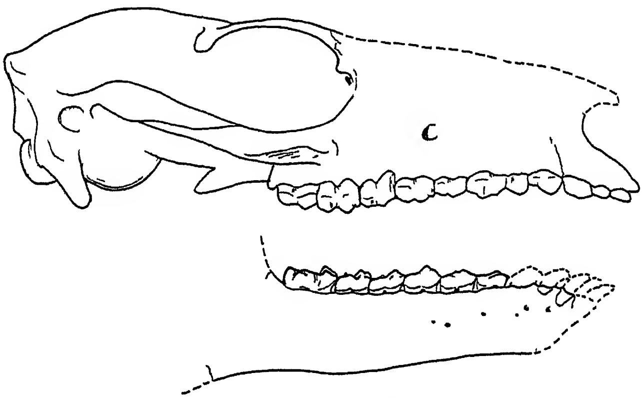


Fig. 4.—*Oldfieldthomasia debilitata* (Ameghino). Museo Nacional No. 10376 (skull only). Jaw composite. Skull and jaws, right lateral view. Three-fourths natural size.

The Endocranial Cast of **Notostylops**

Mus. Nac. No. 10506 includes a natural internal cast of a skull referred to *Notostylops escaridus* which with some preparation has revealed the essential endocranial characters. So far as I know, the only other published notoungulate brain casts are those of *Typotherium* and of *Toxodon*, both Pleistocene, figured by Gervais (1872),[1] copied and discussed by Edinger (1929).[2] The cast of *Notostylops* bears very little resemblance to the large, specialized *Toxodon* but is very similar to *Typotherium*.

The cast of *Notostylops* is of strikingly primitive character, with some resemblance to condylarths on the one hand and rodents on the other.

[1]Gervais, P. 1872. Mémoire sur les formes cérébrales propres à différents groupes de mammifères. Journ. Zool., I, pp. 425–469.

[2]Edinger, T. 1929. Die fossile Gehirne. Ergeb. Anat. u. Entwick, XXVIII, pp. 1–249. [Standard work on the subject, with very full annotated bibliography and copies of most figures, including those of Gervais, above.]

This is harmonious with its dental and osteological characters, which are those of a rather primitive ungulate convergent toward a rodent habitus. The olfactory bulbs are very large, fully exposed, and extend straight out anterior to the cerebrum. The latter is simple, pyriform, much constricted anteriorly and with greatest width posterior to the middle. In dorsal view there are only two distinct sulci. One starts on the dorsal surface, near the middle of its greatest expansion, and passes forward and outward, becoming more distinct, then down around the sides of the anterior part of the cerebrum. This appears to be the fissura sylvii. Between this and the midline, confined to the dorsal surface, is a shorter and less distinct, nearly straight longitudinal sulcus, similar to the sagittal sulcus of *Typotherium* and of many rodents.

The dorsal features of the cerebellum are not clear, and it does not appear to have been very closely applied to the bone. It was broadly exposed and had a little over half the dorsal length of the cerebrum, below which it seems to have been moderately depressed. From this vague cerebellar region, a large vascular sinus runs around the cerebrum on each side, to about the fissura sylvii where it gives off two much smaller vessels directed upward.

Large roughly egg-shaped epitympanic sinuses overlie the cerebellar region dorsolaterally, and still larger and more irregular bullæ laterally and ventrolaterally.

The whole brain occupies about one half the length of the skull, related to the advanced orbits and relatively long cranial part, as noted above.

The Skull of **Oldfieldthomasia**

Ameghino figured teeth of this genus, but the skull has not previously been figured. The accompanying drawing is based on the type of *O. debilitata* (by Ameghino placed in the genus *Acœlodus*[1]), No. 10376 in the Ameghino Collection in the Museo Nacional. It is well preserved except for dorsoventral crushing and loss of the nasals. The lower jaw is composite, based on several lower jaws surely of this genus and either of this or closely related species.

Oldfieldthomasia comes closer than either *Notostylops* or *Notopithecus* to being a really generalized notoungulate.

The most striking peculiarities are the relatively long rostrum and the large orbit placed posterior to the middle. The zygoma arises

[1]It is not proposed to enter into taxonomy here, but it may be noted that *Acœlodus* is a very poorly defined genus and that even if it is really separate from *Oldfieldthomasia* the species *debilitata* belongs in the latter. The type of the genotype of *Oldfieldthomasia* has *five* upper premolars but this is surely an anomaly, or possibly even an artifact, and not a valid character.

opposite M^{2-3} and is slender and relatively feeble. The mandible is unusually long and slender.

The teeth are fully brachyodont, in complete number, and form a closed and rather evenly graded series. The canines are incisiform. In spite of the very different aspect of their more extreme forms as illustrated here, the families Acœlodidæ and Notopithecidæ are apparently closely related, and there are genera which might be placed in either. As they appear to be related to lines wholly distinct in later faunas, this tendency to merge in the *Notostylops* Beds is one of numerous lines of evidence suggesting that the divergence of the Notoungulata was not long anterior.

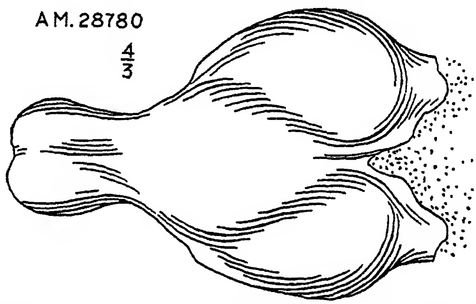


Fig. 5.—*Oldfieldthomasia* sp. Amer. Mus. No. 28780. Endocranial cast, dorsal view. Four-thirds natural size.

The Endocranial Cast of **Oldfieldthomasia**

Of this genus we have an endocranial cast, Amer. Mus. No. 28780, referred to *Oldfieldthomasia* sp., by no means so well preserved as that of *Notostylops* just described, but showing most of the essential dorsal characters.

In general character, this brain is very like that of *Notostylops*, the only striking difference being the relatively smaller olfactory lobes; in *Notostylops* they are well over half the length of the cerebrum, and in this form somewhat less than half. Their position and full exposure are the same. The fissura sylvii is similarly developed, and seems to communicate with a more posterior dorsal fissure, and thus more fully to outline a posterolateral lobe, but this is not wholly certain. The sagittal dorsal sulcus is not clear, and may be absent. Part of a lateral vascular sinus, similar to that of *Notostylops* but relatively smaller, is visible near the fissura sylvii, and there is also preserved part of a median dorsal sagittal sinus.

The fundamental resemblance of the endocrania of *Notostylops*, *Oldfieldthomasia*, and the much later *Typotherium* strongly suggests that they represent a primitive, characteristic notoungulate type of brain, from which the more highly modified (but still relatively archaic) brain of *Toxodon* was probably derived. The modification of the latter appears

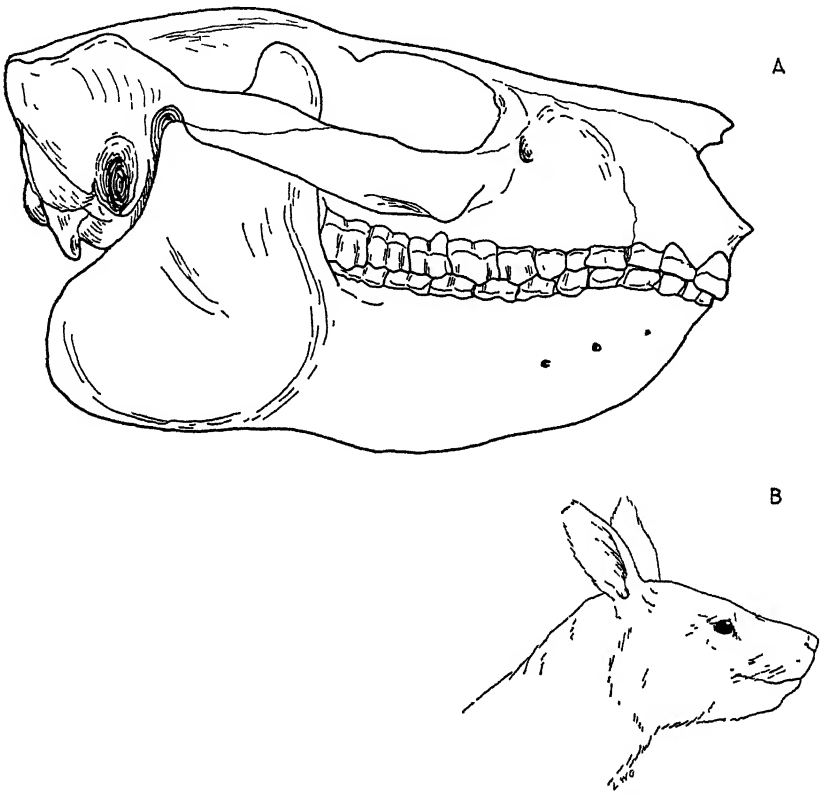


Fig. 6.—*Notopithecus adapinus* Ameghino. Museo Nacional No. 10787. Skull and jaws, right lateral view, one and one-half times natural size, and restoration one-half natural size.

due to change of habits—it is much less macrosmatic—and to mere bulk rather than to markedly superior quality, and so far as this scanty but very suggestive evidence goes, it is fair to conclude that the notoungulates were mentally unprogressive. Certainly they appear to be much less progressive than the artiodactyls or perissodactyls, and this

fact is very interesting in view of their extinction when brought into direct competition with those two groups.

The Skull of **Notopithecus**

A number of good skulls of this genus are known, but none has previously been figured. The present illustration is based on Museo Nacional No. 10787, nearly complete associated skull and jaws referred to *N. adapinus*, with minor additions from other specimens of the same common species.

The skull is short, broad, and deep. In spite of an equal shifting forward of the zygomatic root, to opposite P^4–M^1, the orbit is less definitely anterior to the middle than in *Notostylops*, as the cranium is relatively less elongate and the nasals less retracted. The orbit and brain case are relatively larger, probably simple functions of smaller absolute size. In spite of a different adaptive tendency, there is a distinct heritage resemblance to *Notostylops* and to *Oldfieldthomasia*, which suggests that the time of divergence was not long anterior. In one respect, the inflation of bulla and temporal region, the skull is very highly and, in a manner of speaking, prematurely specialized. Such inflation is a nearly constant notoungulate character, but it here reaches its maximum relative to the total size, probably in part again a function of the small absolute size, but perhaps in part aberrant.

The mandible is noteworthy for its great depth (although relatively very thin transversely) and the enormous expansion of the angular region.

Although apparently advancing in a different direction and with a very different ultimate destiny, the dentition is still very like that of *Oldfieldthomasia*, that is, little removed from the ancestral notoungulate type. The crowns are higher than in *Oldfieldthomasia*, and the coronal pattern more deeply impressed than in *Notostylops*, but the dentition is still brachyodont. As in *Oldfieldthomasia*, it still forms a complete closed and almost evenly graded series, with incisiform canines. The first upper incisors, rather than the third, are slightly enlarged, a prophetic character, while the three lower incisors are of nearly equal size. The occlusion is noteworthy: $I_{1\text{-}2}$ occlude chiefly with I^1, I_3 wholly with I^2, and the lower canine wholly with I^3, less aberrant relations being reached only with P_3 which occludes between P^2 and P^3 as is usual.

This very interesting genus unquestionably lies in or near the ancestry of the Typotheria. Its skull characters lack little of being as specialized as those of the least advanced Santa Cruz forms, although

even the latter present few really important modifications of the generalized notoungulate skull. The dentition of *Notopithecus,* on the contrary, is very much more primitive than in any known later typotheres and suggests either very rapid progress or an unexpectedly long lapse of time between the *Notostylops* and *Pyrotherium* Beds. There are no fully hypsodont mammals in the *Notostylops* Beds, and most, like *Notopithecus,* are definitely brachyodont, even when, as in this case, their direct or collateral descendants early acquired complete hypsodonty.

AMERICAN MUSEUM NOVITATES

Number 579 | Published by The American Museum of Natural History New York City | Nov. 14, 1932

59.9,32 O (8)

THE TAXONOMIC HISTORY OF THE SOUTH AND CENTRAL AMERICAN CRICETID RODENTS OF THE GENUS *ORYZOMYS*.—PART 1: SUBGENUS *ORYZOMYS*

By G. H. H. Tate

In this résumé, the fourth of my series on the Cricetidæ, which I have had to divide into two parts because of its length,[1] I have introduced, on account of the increased complexity of the material and the large number of described forms, a slight change of arrangement in the summaries of species. With the idea of bringing together those names which may at length be proved synonyms or members of only a few well-marked species, I have grouped the species of the larger subgenera approximately under the generalized phytogeographical regions (shown on map, p. 13) within which their type localities fall instead of listing them as in earlier papers in the chronological order of their descriptions. In the case of the *Oryzomys* of Central America however, I have used the "groups" of Goldman (1918).

The allocations made in this paper and hereafter of the old names of Wagner, the Pictets, Lund, and others, are based upon careful reperusal of their work and are purely provisional, being intended merely to suggest probable generic or subgeneric affinities.

Species from north of the Mexican border are not considered.

HISTORICAL STATEMENT[2]

Oryzomys Baird

Subgenus Oryzomys Baird

1801. Azara described (p. 82)[1] RAT SECOND OU RAT A GROSSE TÊTE, (p. 86) RAT TROISIÈME OU RAT ANGOUYA, and (p. 98) RAT SIXIÈME OU RAT A TARSE NOIR (an *Oligoryzomys* ?).

1802. Azara further described (p. 87) RAT A GROSSE TÊTE (under the name COLA IGUAL AL CUERPO), (p. 89) ANGUYA, and (p. 91) RAT A TARSE NOIR (under the name COLILARGO) (an *Oligoryzyomys* ?).

---

[1]The subgenus *Oryzomys* only has been included in Part 1. *Oligoryzomys*, *Thallomyscus*, and *Melanomys* are treated in Part 2. The bibliography for both parts appears at the end of Part 2.

[2]A copy of the newly published 'A Manual of Neotropical Sigmodont Rodents,' by Nils Gyldenstolpe (Kungl. Svenska Vetenskapsakad. Handlingar, (3) XI, No. 3, pp. 1–164 and plates, 1932) has just been received. This work should be consulted for each cricetid genus. It reached my hands too late to receive treatment under the generic headings.

1819. Desmarest applied names to the rats of Azara's FRENCH edition: (p. 62) *Mus angouya* (n. sp.) to his ANGOUYA; (p. 63) *Mus cephalotes* (n. sp.) to his RAT A GROSSE TÊTE; and (p. 64) *Mus nigripes* to his RAT A TARSE NOIR (an *Oligoryzomys* ?).

1820. Desmarest erroneously synonymized (p. 305) ANGOUYA with the RAT DU BRÈSIL (*Holochilus brasiliensis* (Desmarest)).

1830. Rengger remarked upon (p. 229) "*anguya*" and described (p. 232) *Mus longitarsus* (n. sp.) (an *Oligoryzomys* ?).

1832. Bennett described (p. 2) *Mus longicaudatus* (n. sp.) (an *Oligoryzomys* ?).

1835. Bennett described (p. 191) *Mus megallanicus* (n. sp.) (an *Oligoryzomys* ?).

1837. Waterhouse described (p. 19) *Mus flavescens* (n. sp.) (an *Oligoryzomys* ?).

1839. Waterhouse remarked further upon (p. 46) *flavescens* (an *Oligoryzomys*). He described (p. 65) *Mus galapagoensis* (n. sp.). With his erection (p. 75) of *Hesperomys*, a blanket genus, the above species as well as most other American Cricetidæ became included therein.

1841. Lund[1] gave brief and scattered notes upon a number of species of Cricetidæ, the only ones of which belonging clearly to *Oryzomys* were *Mus vulpinus* (n. sp.), preoccupied by *Mus vulpinus* Brants, 1827 (a *Holochilus*), and re-named by Schinz, 1845, *vulpinoides;* and *Mus laticeps* (n. sp.), a rather short-tailed form (pp. 279–280). Lund's description of "*Mus longicaudatus*" suggests *Oligoryzomys*. *Expulsus* Lund was placed by Trouessart, 1898, in *Oryzomys*, but later removed by Thomas to *Hesperomys*.

1842. Wagner described (p. 362) *Hesperomys subflavus* (n. sp.), which description strongly suggests the genus *Delomys* Thomas (see *Delomys*, 1917). He described also (p. 361) *Hesperomys arviculoides* and *H. orobinus* (both *Zygodontomys* ?). They were placed by Trouessart in *Oryzomys;* but after reading carefully Wagner's amplified description in the 'Säugethiere Supplement' I cannot endorse that opinion.

1843. Wagner placed (p. 517) *galapagoensis* in *Hesperomys* (*Habrothrix*).

1844. Pictet and Pictet wrote of (p. 61) "*angouya*," which they had received from Bahia. Their figure (Pl. xv) is unquestion-

[1]A German translation of parts of Lund's work may be found in Isis, 1843, XXXVI, pp. 738–760.

ably that of an *Oryzomys*, but it is uncertain whether their specimen was identical with *angouya* Desmarest.

They described (p. 64) *Mus cinnamomeus* (n. sp.) and figured it (Pls. XIX and XXIII, fig. 5). This animal again strongly suggests one of the shorter-tailed *Oryzomys*. They also described (p. 67) *Mus maculipes* (n. sp.) an *Œcomys*-like (?) animal with very white underparts.

1845. Wagner described (p. 147) *Hesperomys concolor* (n. sp.), *Hesperomys eliurus* (n. sp.), *Hesperomys pygmæus* (n. sp.) (the last two *Oligoryzomys*), and *Hesperomys brachyurus* (n. sp.) (a *Zygodontomys* ?). The last he thought probably identical to *lasiurus* (Lund) (a *Zygodontomys* ?).

1845. Schinz described (p. 193) *Mus vulpinoides* (n. sp.), based upon the *Mus vulpinus* of Lund (1841).

1848. Peale described (p. 51) *Mus peruvianus*, n. sp. (an *Oligoryzomys* ?).

1850. Wagner further described (p. 309) *pygmæus* (an *Oligoryzomys*), (p. 311) *concolor*, and (p. 313) *brachyurus* (a *Zygodontomys*).

1854. Burmeister discussed (p. 171) *laticeps* and (p. 173) *eliurus* (an *Oligoryzomys*) under *Hesperomys* (*Calomys*) and in an appendix (p. 185) remarked upon species contained in recent works by Lund, Wagner, and Pictet.

1855. Burmeister (1854), reviewing the status of "*Hesperomys*," discussed briefly (p. 7) *anguya* Azara, *laticeps* (referring *subflavus* and *cephalotes* to it), *longicaudatus*, *eliurus*, and *flavescens* (the three last *Oligoryzomys*).

1859. Baird, giving a careful diagnosis, erected (pp. 457–458) *Oryzomys* new subgenus of *Hesperomys* with type and (then) only species *Hesperomys palustris* (Harlan). *Oryzomys* as now understood is much broader than Baird originally allowed.

1860. De Saussure, discussing the Cricetidæ of Mexico, described (pp 98, 102–103) *Hesperomys fulvescens* (n. sp.) (an *Oligoryzomys*).

1860*b*. Tomes described (p. 254) *Hesperomys albigularis*, n. sp.

1872. Hensel described (p. 36) *Hesperomys ratticeps*, n. sp. He gave (p. 37) added information about *flavescens* (an *Oligoryzomys*) and described (p. 42) *dorsalis* (a *Delomys*). He wrote concerning "*darwinii* Waterhouse" which later was described by Leche as a new subspecies of *laticeps*.

1874. Coues re-characterized (p. 183) the subgenus *Oryzomys*.

1876. Alston described *Hesperomys couesi*, n. sp. (see Thomas, 1893).

1877. Coues further delineated (p. 111) the genus *Oryzomys*.
1880. Alston, in his synopsis of the Central American species of *Hesperomys*, placed (p. 143) *couesi* in the subgenus *Oryzomys*.
1881. Thomas described (p. 4) *Hesperomys* (*Calomys*) *coppingeri*, n. sp. (an *Oligoryzomys*).
1882. Thomas, reporting Stolzmann's large collection from Peru (pp. 102–105), clearly used *Calomys* in the subgeneric sense for those animals which today are classed in *Oryzomys*, i.e., "*laticeps*," "*albigularis*," "*longicaudatus*" (an *Oligoryzomys* re-named *stolzmanni* in 1894), and also *spinosus*, n. sp. (later made the type of *Neacomys*).
1883. Pelzeln, writing of Natterer's specimens, gave additional data on *eliurus*, *pygmæus* (both *Oligoryzomys*), and *concolor*.
1884. Thomas, reporting Jelski's collection from Peru, revised (p. 448) the subgenera of *Hesperomys*. Prior to this, most *Oryzomys* had been placed in *Calomys* Waterhouse.[1] He now included with the type, *palustris*: *angouya*, *albigularis*, *galapagoensis*, *longicaudatus* (an *Oligoryzomys*), and *spinosus* (a *Neacomys*)—" . . . nearly 30 in all."
He described *Hesperomys* (*Oryzomys*) *laticeps nitidus*, n. subsp.
1886. Leche commented (p. 692) upon *ratticeps*. He described (p. 693) *H. laticeps intermedia*, n. var., based upon "*darwinii*" of Hensel, 1872, and discussed *saltator* (not described by Winge until 1887).
1886. Thomas reached the (probably erroneous) conclusion (pp. 421–422) that *pyrrhorhinus* Wied (a *Rhipidomys*) was really an *Oryzomys*.
1887. Winge compared (p. 46) *laticeps* with "*longicaudatus*" (an *Oligoryzomys*) and described (p. 48) *Calomys saltator*, new name (referred to by Leche, 1886, and Thomas, 1901). He treated (p. 51) *laticeps* exhaustively. His *tener* (p. 15) was placed in *Oryzomys* by Trouessart (1898) and later removed by Thomas to *Hesperomys*.
1890. Coues raised (p. 4164) *Oryzomys* to generic rank—"An American genus . . . "
1891*a*. J. A. Allen described (p. 214) *Hesperomys* (*Oryzomys*) *alfaroi*, n. sp.
1891*b*. J. A. Allen, describing (p. 289) *Oryzomys aquaticus*, n. sp., in-

[1]For discussion of untenability of *Calomys* see Tate, 1932, Amer. Mus. Novit., No. 541, pp. 10, 11, 14.

dicated (p. 294) his preference that *Oryzomys* should be treated as a full genus.

1891*c*. J. A. Allen described (p. 193) *Oryzomys talamancæ*, n. sp.

1892. J. A. Allen described (p. 48) *Oryzomys bauri*, n. sp.

1893. Goeldi wrote of *ratticeps* under *Hesperomys*, omitting subgeneric distinction.

1893. Thomas remarked upon (p. 403) the composite nature of *couesi* and selected the type. He restricted the species and proposed (p. 403) *Oryzomys fulgens*, n. sp., and (p. 404) *Oryzomys melanotis*, n. sp.

1893. Ihering listed under subgenus *Oryzomys: dorsalis* (a *Delomys*), *laticeps*, and *pyrrhorhinus* (a *Rhipidomys*). He placed *ratticeps* under subgenus *Calomys*.

1893. Allen and Chapman described (p. 212) *Oryzomys speciosus*, n. sp., (p. 213) *Oryzomys trinitatis*, n. sp., (p. 214) *Oryzomys velutinus*, n. sp., and (p. 215) *Oryzomys brevicauda*, n. sp. (The last was removed in 1897 to *Zygodontomys*).

1893. J. A. Allen described (p. 239) *Oryzomys costaricensis*, n. sp. (an *Oligoryzomys*).

1894. Thomas, after temporarily rejecting (p. 350) *Thomasomys* Coues as only doubtfully worthy of retention, described the following mice under the general name *Oryzomys:* (p. 349) *kalinowskii*, n. sp. (a *Thomasomys*); (p. 350) *incanus*, n. sp. (an *Inomys*); (p. 351) *meridensis*, n. sp.; (p. 351) *flavicans*, n. sp.; (p. 352) *ferrugineus*, n. sp. (a *Phænomys*); (p. 354) *xantheolus*, n. sp.; (p. 355) *phæopus*, n. sp. (a *Melanomys*); (p. 356) *phæopus obscurior*, n. subsp. (a *Melanomys*); (p. 357) *stolzmanni*, n. sp. (an *Oligoryzomys*); (p. 358) *gracilis*, n. sp.; (p. 358) *microtinus*, n. sp. (moved to *Zygodontomys* in 1898); and (p. 359) *Oryzomys* ? (*sic*) *venustus*, n. sp. (a *Hesperomys*).

1895. J. A. Allen described (p. 329) *Oryzomys cherriei*, n. sp. (in 1897 made type of *Zygodontomys*).

1895*a*. Thomas recorded (p. 57) "*gracilis*" from Managua, Costa Rica. He described (p. 58) *Oryzomys princeps*, n. sp. (a *Thomasomys*), suggesting its possible affinity with *Rhipidomys;* (p. 59) *Oryzomys childi*, n. sp. (synonym of *meridensis* according to Bangs, 1900), and (p. 59) *Oryzomys laniger*, n. sp. (a *Thomasomys*).

1895*b*. Thomas described (p. 368) *Oryzomys instans*, n. sp. (a *Chilomys*).

1896. Thomas described (p. 305) *Oryzomys niveipes*, n. sp. (a *Thomasomys*), and *Oryzomys* ? (*sic*) *lugens*, n. sp. (in 1898 made type of *Æpeomys* n. g.).

1897. Allen and Chapman described (p. 19) *Oryzomys delicatus*, n. sp. (an *Oligoryzomys*).

1897*a*. J. A. Allen commented upon (p. 36) the type of *talamancæ* and described (p. 37) *Oryzomys chrysomelas*, n. sp. (a *Melanomys*). He made *cherriei* type of *Zygodontomys*, n. g., and included with it *brevicauda*.

1897*b*. J. A. Allen described (p. 52) *Oryzomys mexicanus*, n. sp., based upon material which in 1890 he had referred to *couesi*. He now considered it distinct from the *couesi* group and near *aquaticus*.

He described also (p. 53) *Oryzomys bulleri*, n. sp.

1897*c*. J. A. Allen described (p. 117) *Oryzomys baroni*, n. sp.

1897*d*. J. A. Allen commented (p. 205) upon a series of "*Oryzomys melanotis* Thomas" (in 1898 re-named *chapmani*). He described *Oryzomys jalapæ*, n. sp.

1897*b*. Thomas described (p. 494) *Oryzomys goeldi*, n. sp. He removed *instans* from *Oryzomys*, making it type of *Chilomys*, n. g.

1897*c*. Thomas described (p. 548) *Oryzomys peninsulæ*, n. sp.

1898. Bangs described (p. 164) *Oryzomys flavicans illectus*, n. subsp.

1898*a*. Thomas described (p. 177) *Oryzomys antillarum*, n. sp., (p. 178). *Oryzomys victus*, n. sp. (an *Oligoryzomys*), and (p. 179) *Oryzomys chapmani*, n. sp., based upon the "*melanotis*" of Allen (1897, p. 205).

1898*b*. Thomas described (p. 454) *Oryzomys vestitus*, n. sp. (a *Thomasomys*).

1898*c*. Thomas described (p. 267) *Oryzomys dryas*, n. sp., based upon a skin from Pallatanga, Ecuador, referred by him in 1894 to *minutus*, (p. 268) *Oryzomys dryas humilior*, n. subsp. (both *Thallomyscus*), and (p. 268) *Oryzomys flavicans subluteus*, n. subsp.

1898. Merriam described (p. 15) *Oryzomys nelsoni*, n. sp.

1898. Trouessart listed (p. 523–529) the following species under *Oryzomys* which have since been removed: *aureus* (a *Thomasomys*), *orobinus* Wagner (a *Zygodontomys*), *brachyurus* Wagner (a *Zygodontomys*), *arviculoides* Wagner (a *Zygodontomys*), *peruvianus* Peale (see also Cassin, 1858) (an *Oligoryzomys*), *tener* Winge (a *Hesperomys*), *expulsus* Lund

(a *Hesperomys*), "*musculipes*," a misprint for *maculipes* Pictet (an *Œcomys* ?), *spinosus* (a *Neacomys*), *venustus* (a *Hesperomys*), *microtinus* (corrected to *Zygodontomys*, appendix, p. 1327), *cherriei* (a *Zygodontomys*), *brevicauda* (a *Zygodontomys*), *princeps* (a *Thomasomys*), *ferrugineus* (a *Phænomys*).[1]

1899. Bangs described (p. 9) *Oryzomys navus*, n. sp. (an *Oligoryzomys*).

1899. J. A. Allen described the following *Oryzomys*: *Akodon columbianus*, n. sp. (removed in 1904 to *Oryzomys* (*Melanomys*)); (p. 204) *maculiventer*, n. sp.; (p. 206) *trichurus*, n. sp.; (p. 207) *sanctæmartæ*, n. sp. (a *Zygodontomys*); (p. 208) *mollipilosus*, n. sp.; (p. 209) *magdalenæ*, n. sp.; (p. 210) *villosus*, n. sp.; (p. 210) *palmarius*, n. sp.; (p. 211) *tenuicauda*, n. sp.; (p. 212) *modestus*, n. sp.; and (p. 212) *fulviventer*, n. sp.

1899*a*. Thomas described (p. 152) *Oryzomys bæops*, n. sp. (a *Thomasomys*).

1899*b*. Thomas described (p. 280) *Oryzomys indefessus*, n. sp. (a *Nesoryzomys*).

1899*c*. Thomas described (p. 379) *Oryzomys auriventer*, n. sp.

1900. Bangs declared (p. 93) *childi* a synonym of *meridensis* and recorded "*laticeps*" from Santa Marta (see Allen, 1904*a*). He was inclined to believe (p. 94) that Allen's *trichurus* was a *Rhipidomys*.

He erected (p. 94) *Oligoryzomys*, n. subg. of *Oryzomys* with type *Oryzomys navus* Bangs to contain the "pygmy oryzomys," and included *dryas humilior* in the subgenus.

He erected (p. 96) a second subdivision, *Erioryzomys*, n. subg., with type *Oryzomys monochromos*, n. sp. *Erioryzomys* was practically equivalent to *Thomasomys*.

The following is a list of the species described previous to Bang's paper, which seem to me (see remarks in Part 2, p. 3) to belong either in *Oligoryzomys* or *Thallomyscus*.

nigripes	*eliurus*	*costaricensis*
longitarsus	*pygmæus*	*delicatus*
longicaudatus	*peruvianus*	*stolzmanni*
magellanicus	*minutus*	*victus*
flavescens	*fulvescens*	*dryas* (*Thallomyscus*)
destructor	*coppingeri*	*dryas humilior* (*Thallomyscus*)
melanostoma		*navus*

1900. J. A. Allen described (p. 225) *Oryzomys keaysi*, n. sp., and *Oryzomys obtusirostris*, n. sp.

1900*a*. Thomas described (p. 272) *Oryzomys sylvaticus*, n. sp., and (p. 273) *Oryzomys balneator*, n. sp., whose nearest ally he stated to be *bæops* (a *Thomasomys*).

1900*b*. Thomas described (p. 354) *Oryzomys prætor*, n. sp. (a *Thomasomys*), remarking upon the *Thomasomys* group of rats.

1901*a*. Merriam described (p. 103) *Oryzomys cozumelæ*, n. sp. (This description of July 19 apparently antedates that given in Proc. Wash. Acad. Sci., III, p. 280, dated July 26.)

1901*b* Merriam, in his 'Synopsis' of *Oryzomys* described the following species from south of the Mexican border: (p. 279) *albiventer*, n. sp.; (p. 280) *cozumelæ*, "n. sp." (see previous statement, 1901*a*); (p. 281) *crinitus*, n. sp.; (p. 282) *crinitus aztecus*, n. subsp.; (p. 283) *mexicanus peragrus*, n. subsp.; (p. 284) *richmondi*, n. sp.; (p. 285) *jalapæ rufinus*, n. subsp.; (p. 285) *zygomaticus*, n. sp.; (p. 286) *teapensis*, n. sp.; (p. 287) *rufus*, n. sp.; (p. 288) *goldmani*, n. sp.; (p. 289) *chapmani caudatus*, n. subsp.; (p. 290) *chapmani saturatior*, n. subsp.; (p. 290) *chapmani dilutior*, n. subsp.; (p. 290) *palatinus*, n. sp.; (p. 291) *hylocetes*, n. sp.; (p. 291) *rhabdops*, n. sp.; (p. 292) *angusticeps*, n. sp.; (p. 293) *rostratus*, n. sp.; (p. 294) *rostratus megadon*, n. subsp.; and (p. 294) *yucatanensis*, n. sp.

He divided the North and Central American species of *Oryzomys* into four main groups: *palustris-mexicanus* group, *chapmani* group, *melanotis* group, and *fulvescens* group. (This last was equal to *Oligoryzomys*.)

1901*b*. Thomas described (p. 251) *Oryzomys tectus*, n. sp., and (p. 252) *Oryzomys panamensis*, n. sp.

1901*c*. Thomas, writing of *subflavus* Wagner (a *Delomys* ?), considered (p. 528) that "*laticeps*" of Winge, "*vulpinus*" Lund, and *vulpinoides* Schinz (new name for the latter) were synonyms of *subflavus*.

He described (p. 528) *Oryzomys lamia*, n. sp., and stated (p. 530) that *saltator* Winge represented the original *O. laticeps* Lund.

He also described (p. 536) *Oryzomys boliviæ*, n. sp., comparing it with "*intermedius*" (Leche).

1901. J. A. Allen described (p. 405) *Oryzomys bolivaris*, n. sp., (p. 406) *Oryzomys castaneus*, n. sp., (p. 406) *Oryzomys perenensis*, n. sp., and (p. 407) *Oryzomys rivularis*, n. sp.

1902. Bangs described (p. 34) *Oryzomys devius*, n. sp.
He listed (p. 37) *chrysomelas* Allen (a *Melanomys*) under *Zygodontomys*.

1902*a*. Thomas remarked (p. 60) upon *dorsalis obscura* Leche (a *Delomys*).

1902*b*. Thomas described (p. 129) *Oryzomys levipes*, n. sp., and (p. 130) *Oryzomys yunganus*, n. sp.

1902*c*. Thomas described (p. 247) *Oryzomys phæopus olivinus*, n. subsp. (a *Melanomys*), and (p. 248) proposed separating *Melanomys*, n. subg. with type *O. phæopus.*

The following species, described previous to Thomas's paper (1902), are now considered by authors to belong in *Melanomys*.

phæopus phæopus
phæopus obscurior
chrysomelas
columbianus

1902. Robinson and Lyon described (p. 142) *Oryzomys medius*, n. sp.

1903. Elliot described (p. 145) *Oryzomys molestus*, n. sp.

1903. Thomas again advised (pp. 40–41) the separation of *Melanomys* from *Oryzomys*.

1904. Elliot described (p. 266) *Oryzomys jalapæ apatelius*, n. subsp.

1904. Thomas described (p. 142) *Oryzomys oniscus*, n. sp.

1904*a*. J. A. Allen described (p. 327) *Oryzomys klagesi*, n. sp. He stated (p. 439) that *maculiventer* Allen = *meridensis* Thomas (see also Bangs, 1900), and that *mollipilosus* Allen = "*laticeps*" Bangs.

1904. Heller, after listing *Oryzomys galapagoensis* and *O. bauri*, erected (p. 241) *Nesoryzomys*, n. g. He removed *indefessus* Thomas to *Nesoryzomys*.

1905. J. A. Allen, after listing the several subgenera in the synonymy of *Oryzomys*, briefly outlined (p. 46) the genus.

1905. Trouessart recognized (pp. 415–423) the subgenera *Oryzomys*, *Melanomys*, *Oligoryzomys*, and *Erioryzomys*. The last contained only *monochromos* and *laniger*, but a footnote suggesting inclusion of *bæops*, *niveipes*, *vestitus*, *villosus*, etc. Thus *Erioryzomys* was practically a synonym of *Thomasomys*. Under *Oryzomys*, Trouessart listed, in addition to the long series of names which may now be taken as rightly belonging there, the following: (p. 419) *aureus* Tomes (a *Thomasomys*); *stolzmanni* (an *Oligoryzomys*); *indefessus* (a *Nesoryzomys*);

(p. 420) *orobinus*, *brachyurus* (both *Zygodontomys*); (p .421) *tener* and *venustus* (both *Hesperomys*, *sensu stricto*). "*Anguya* Azara" was written (p. 420) for *angouya* Desmarest. *Flavescens* was made a subspecies of *longicaudatus*. *Philippii*, shown by Wolffsohn (1910) to be a synonym of *longicaudatus* (an *Oligoryzomys*), was allowed (p. 421) specific rank. *Vulpinoides* was made a synonym of *subflavus* Wagner. A whole series of the *Mus* species of Philippi was stated in a footnote (p. 421) to be probably *Oryzomys*.

Trouessart removed (p. 408) *pyrrhonotus*, *kalinowskii*, *incanus* (an *Inomys*), and *paramorum* from *Oryzomys* and placed them with the original *cinereus* and *taczanowskii* of Coues in *Thomasomys*.[1]

1906. Thomas, in addition to the species listed by Trouessart (1905, p. 408), removed (p. 443) *princeps*, *aureus*, *bæops*, *niveipes*, *ferrugineus* (a *Phænomys*), *dorsalis* and *sublineatus* (both *Delomys*) from *Oryzomys* to *Thomasomys*.

1908. J. A. Allen described (p. 655) *Oryzomys alfaroi incertus*, n. subsp., *Oryzomys ochraceus*, n. sp. (shown by Goldman 1916 to be a *Nectomys*), and *Oryzomys carrikeri*, n. sp.

1910. Thomas described (p. 186) *Oryzomys macconnelli*, n. sp.

1910. J. A. Allen thought (p. 98) *richmondi* Merriam "very near to, if not the same as" *couesi* Thomas and synonymized *alfaroi incertus* Allen with *alfaroi*. He described (p. 99) *Oryzomys richardsoni*, n. sp.

1911. Goldman described (p. 5) *Oryzomys idoneus*, n. sp. (a *Melanomys*), *Oryzomys frontalis*, n. sp., *Oryzomys bombycinus*, n. sp., and *Oryzomys gatunensis*, n. sp.

1912. Osgood described (p. 49) *Oryzomys griseolus*, n. sp. (an *Oligoryzomys*).

1912. J. A. Allen described (p. 83) *Oryzomys palmiræ*, n. sp., and *Oryzomys pectoralis*, n. sp.

1913. Goldman described (p. 5) *Oryzomys pirrensis*, n. sp.

1913*b*. J. A. Allen, when revising (pp. 533–555) the group *Melanomys*, treated it (p. 535) as a full genus, recognizing fourteen forms. He emphasized (p. 534) its distinctness from *Zygodontomys*.

1913*c*. J. A. Allen described (p. 597) *Oryzomys helvolus*, n. sp., (p. 597) *Oryzomys o'connelli*, n. sp., (p. 598) *Oryzomys vicencianus*, n. sp., and (p. 598) *Oryzomys incertus* (preoccupied by *incertus* Allen, 1908, and re-named *mureliæ* Allen, 1915).

[1]Additional Note: *Hesperomys dorsalis obscura* Leche, 1886, was held to be preoccupied by *Mus* (*Abrothrix*) *obscurus* Waterhouse, 1837 (an *Akodon*) and *dorsalis lechei* was proposed in its stead.

1913. Osgood described (p. 97) *Oryzomys polius*, n. sp. He remarked (p. 98) that *O. baroni* appeared to be only a slightly differentiated subspecies of *xantheolus*.

1914. Thomas described (p. 241) *Oryzomys albigularis mærex*, n. subsp., and (p. 242) *Oryzomys caracolus*, n. sp.

1914*b*. Osgood suggested (p. 157) that *baroni* was perhaps indistinguishable from *xantheolus*, but actually only reduced it to the subspecies *xantheolus baroni*.

1915. J. A. Allen re-named *incertus* Allen, 1913 (preoccupied by *alfaroi incertus* Allen, 1908), *murelıæ*.

1915. Goldman described (p. 127) *Oryzomys guerrensis*, n. sp., (p. 128) *Oryzomys nitidus alleni*, n. subsp., (p. 128) *Oryzomys alfaroi dariensis*, n. subsp., (p. 129) *Oryzomys couesi regillus*, n. subsp., and (p. 130) *Oryzomys fulvescens lenis*, n. subsp. (an *Oligoryzomys*).

1916*a*. Goldman stated (p. 127) that *ochraceus* Allen (1908) was not an *Oryzomys* but a *Nectomys*.

1916*a*. J. A. Allen described (p. 85) *Oryzomys barbacoas*, n. sp.

1917*a*. Thomas erected (p. 1) *Microryzomys*, new subgenus of *Oryzomys*, with type *Oryzomys minutus* Tomes and described (p. 1) *Oryzomys* (*Microryzomys*) *aurillus*, n. sp.

1918. Goldman published 'The Rice Rats of North America.' In his revision, instead of the four groups of Merriam (1901), he used three subgenera, *Oryzomys*, *Oligoryzomys*, and *Melanomys* (reduced again to subgeneric rank—see Allen 1913), the first of which he divided into eight groups. A number of forms were reduced to synonymy or subspecific rank (see list of species).

He described (p. 51) *Oryzomys melanotis colimensis*, n. subsp.

1921*a*. Thomas described (p. 177) *Oryzomys wavrini*, n. sp.

1921*b*. Thomas described (p. 449) *Oryzomys barbacoas ochrinus*, n. subsp.

1921*c*. Thomas described (p. 356) *Oryzomys intectus*, n. sp.

1921*d*. Thomas remarked (p. 228) further upon *Oryzomys* (*Microryzomys*) *aurillus*.

1924. Miller divided (pp. 352–364) *Oryzomys* into the subgenera *Oryzomys*, *Oligoryzomys* and *Melanomys*. He followed Goldman (1918) quite closely.

1924. Thomas wrote (p. 143) briefly on *Oryzomys ratticeps* and described *Oryzomys ratticeps tropicius*, n. subsp., and *Oryzomys ratticeps paraganus*, n. subsp.

1924. Anthony described (p. 7) *Oryzomys balneator hesperus*, n. subsp.
1925. Thomas described (p. 577) *Oryzomys legatus*, n. sp.
1926. Anthony described (p. 4) *Oryzomys auriventer nimbosus*, n. subsp.
1927*b*. Thomas listed (pp. 548–549) his choice of lectotypes and lectoparatypes in the British Museum for the following forms:

	Lectotypes	Lectoparatypes	Remarks
couesi male	75.2.26.15 Coban, Guatemala	60.2.11.8 and 79.6.20.3	Already selected: 1893
nitidus male	85.4.1.41 Amable Maria, Peru		Specimen figured

1927*c*. Thomas agreed (p. 599) with Osgood (1914) that *baroni* should be synonymized with *xantheolus*.
1932. Murie (1932) described (p. 1) *Oryzomys couesi pinicola*, n. subsp.
1932. Harris described (p. 5) *Oryzomys aphrastus*, n. sp.

PRESENT STATUS OF *ORYZOMYS* AND ITS SUBGENERA

Genus *Oryzomys* Baird	Type by original designation: *Mus palustris* Harlan
Subgenus *Oryzomys* Baird	
Subgenus *Oligoryzomys* Bangs (=*Microryzomys* Thomas)	Type by original designation: *Oryzomys navus* Bangs
Subgenus *Thallomyscus* Thomas	Type by original designation: *Oryzomys dryas* Thomas
Subgenus *Melanomys* Thomas	Type by original designation: *Oryzomys phæopus* Thomas

List of Named Forms with Type Localities

As stated at the beginning of this paper, the larger subgenera have been classed under generalized phytogeographical provinces, illustrated in the accompanying map and defined below. That the areas are often of highly complex nature and intergrade freely is admitted. However, it is believed that each region expresses a certain broad homogeneity of fauna and flora.

In constructing the map, works on plant geography by Strasburger, Hardy and others, on ornithology by Chapman, and other general reports have been consulted.

Phytogeographical Provinces

1.—Central America north of Lake Nicaragua. The line of transition in this region has been pointed out by Harshberger, 1911, 'Die Vegetation der Erde,'

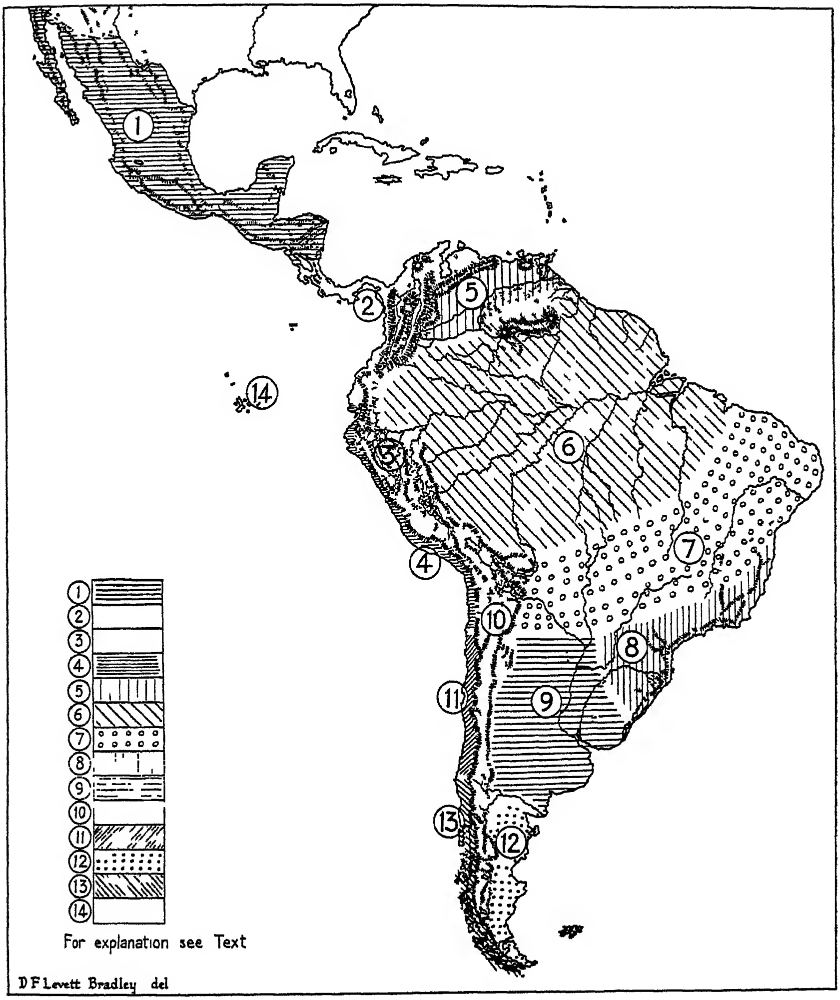


Fig. 1. Map to show phytogeographical areas of Central and South America. For definitions see text, pp. 12-14.

XIII, p. 668. I have not yet worked upon the subdivisions of this area and provisionally treat it as a unit.

2.—From Lake Nicaragua, south and east through Panama to the Caribbean and Pacific coastal strips,—eastward to La Guaira, Venezuela, and southward to Ecuador. The region includes the Andean slopes as high approximately as 6000 feet.

3.—The Andes north of Chile from 6000 feet[1] up to paramo.

4.—Costal arid region from southern Ecuador to northern Chile.

5.—Central and eastern Venezuela with Trinidad and other nearby islands.

6.—Amazonia, from Guiana and Pará, including Guiana Mountains, to the Andes from Colombia to Bolivia, up to 6000 feet.

7.—The "caatinga" region of Ceará to the savannas of Matto Grosso and the northern chaco, including northern Jujuy.

8.—The moist subtropics and temperate of southern Brazil and eastern Paraguay.

9.—The pampas of Uruguay and Argentina (delta of Parana River included).

10.—The upper slopes of the Andes south of Bolivia. Above 5000–6000 feet.

11.—The "mediterranean" lowlands of the Chilean central provinces.

12.—Arid Patagonian area and arid foothills west and south of San Luis, Argentina.

13.—Temperate rain forests from Valdivia, Chile to Fuegia.

14.—Galapagos Islands.

Oryzomys (*Oryzomys*)

In listing the Central American forms of this subgenus I have followed Goldman's revision of the North American (and Jamaican) species, with the exception of his Panamanian groups *bombycinus*, *devius*, and *tectus*. The species of these three groups I have included in my phytogeographical region No. 2.

It will be seen that the subgenus appears to be absent only from regions 9 to 13.

Central American region based upon Goldman (includes region 1)

couesi couesi (Alston)	Coban, Guatemala
teapensis Merriam[2]	Teapa, Tabasco, Mexico
goldmani Merriam[2]	Coatzacoalcos, Vera Cruz, Mexico
jalapæ Allen[2]	Jalapa, Mexico
jalapæ rufinus Merriam[2]	Catemaco, Vera Cruz, Mexico
jalapæ apatelius Elliot[2]	San Carlos, Vera Cruz, Mexico
richardsoni Allen[2]	Peña Blanca, Atlantic coast forests, Nicaragua, 1500 ft.
couesi richmondi Merriam	Escondido River, Nicaragua
couesi zygomaticus Merriam	Nenton, Guatemala
couesi mexicanus Allen	Hacienda San Marcos, Jalisco, Mexico
bulleri Allen[3]	Valle de Banderas, Terro Tepic, Jalisco, Mexico
rufus Merriam[3]	Santiago, Tepic, Mexico

[1]Not rigidly adhered to. Species from about 6000 feet are placed in highland or lowland group according to their seeming affinities.
[2]Synonymized by Goldman with *couesi couesi* (Alston).
[3]Synonymized by Goldman with *couesi mexicanus* Allen.

couesi aztecus Merriam	Yautepec, Morelos, Mexico
couesi crinitus Merriam	Tlalpam, Federal District, Mexico
couesi regillus Goldman	Los Reyes, Michoacan, Mexico
couesi albiventer Merriam	Ameca, Jalisco, Mexico
couesi pinicola Murie	Twelve miles south of El Cayo, British Honduras
molestus Elliot[1]	Ocotlan, Jalisco, Mexico
couesi peragrus Merriam	Rio Verde, San Luis Potosi, Mexico
fulgens Thomas	"Mexico"
gatunensis Goldman	Gatun, Canal Zone, Panama
cozumelæ Merriam	Cozumel Island, Mexico
antillarum Thomas	Jamaica
peninsulæ Thomas	Santa Anita, Lower California, Mexico
nelsoni Merriam	Maria Madre Island, Mexico
melanotis melanotis Thomas	Mineral San Sebastian, Jalisco, Mexico
melanotis colimensis Goldman	Armeria, Colima, Mexico
rostratus rostratus Merriam	Metlaltoyuca, Puebla, Mexico
rostratus megadon Merriam	Teapa, Tabasco, Mexico
rostratus yucatanensis Merriam	Chichen Itza, Yucatan, Mexico
alfaroi alfaroi (Allen)	San Carlos, Costa Rica
alfaroi incertus Allen[2]	Rio Grande, south of Tuma, Nicaragua
alfaroi dariensis Goldman	Cana, Panama, 2000 ft.
alfaroi angusticeps Merriam	Volcan Santa Maria, Guatemala
alfaroi rhabdops Merriam	Calel, Guatemala
alfaroi caudatus Merriam	Comaltepec, Oaxaca, Mexico
alfaroi palatinus Merriam	Teapa, Tabasco, Mexico
alfaroi saturatior Merriam	Tumbala, Chiapas, Mexico
alfaroi chapmani Thomas	Jalapa, Vera Cruz, Mexico
alfaroi dilutior Merriam	Huauchinango, Puebla, Mexico
guerrerensis Goldman	Omilteme, Guerrero, Mexico
hylocetes Merriam	Chicharras, Chiapas, Mexico
talamancæ Allen	Talamanca, Costa Rica
panamensis Thomas[3]	Open savanna, City of Panama, Panama
carrikeri Allen[6]	Rio Sicsola, Talamanca, Costa Rica
aphrastus Harris	Joquin de Dota, Pacific slope of mountains south of Cartago, Costa Rica

Region 2 (north and south of the Andes, and Panama)

flavicans flavicans Thomas	Mérida, Venezuela
flavicans illectus Bangs	Pueblo Viéjo, Santa Marta Mts., Colombia
flavicans subluteus Thomas	Western Cundinamarca, Colombia
gracilis Thomas	Concordia, Medellin, Colombia
trichurus Allen	El Libano plantation, near Bonda,

[1]Synonymized by Goldman with *couesi albiventer* Merriam.
[2]Synonymized by Goldman with *alfaroi alfaroi* (Allen).
[3]Synonymized by Goldman with *talamancæ* Allen.

	Santa Marta district, Colombia, 500 ft.
mollipilosus Allen	Valparaiso, Santa Marta district, Colombia, 4500 ft.
sylvaticus Thomas	Santa Rosa, Southern Ecuador
magdalenæ Allen	Minca, Santa Marta district, Colombia, 2000 ft.
villosus Allen	Valparaiso, Santa Marta district, Colombia, 4500 ft.
tectus tectus Thomas	Bogava, Chiriqui, Panama
tectus frontalis Goldman	Corozal, Canal Zone, Panama
bolivaris Allen	Porvenir, Bolivar, Ecuador
castaneus Allen	St. Javier, northwestern Ecuador
rivularis Allen	Rio Verde, northern Ecuador, 3200 ft.
devius Bangs	Boquete, Panama
medius Robinson and Lyon	San Julian, eight miles east of La Guaira, Venezuela
bombycinus bombycinus Goldman	Cerro Azul, Chagres R., Panama, 2500 ft.
bombycinus alleni Goldman	Tuis, 35 miles east of Cartago, Costa Rica
palmiræ Allen	Mira Flores, east of Palmira, eastern slope of central Andes, Colombia, 6200 ft.
pirrensis Goldman	Rio Limon, Mt. Pirri, eastern Panama, 4500 ft.
caracolus Thomas	Galiparé, Cerro de Avila, near Caracas, Venezuela
barbacoas barbacoas Allen	Barbacoas, southwestern Colombia, 75 ft.
barbacoas ochrinus Thomas	"West of Quito," Ecuador
intectus Thomas	Santa Elena, Medellin, Colombia

Region 3 (Andes above 6000 ft.)

albigularis albigularis (Tomes)	"taken *en camino* on my return from Pallatanga." Ecuador.
albigularis mærex Thomas	Mindo, northwest of Quito, Ecuador
meridensis Thomas[1]	Mérida, Venezuela
childi Thomas[1]	Bogotá, Colombia
maculiventer Allen[2]	Sierra el Libano, Santa Marta district, Colombia 6000 ft.
auriventer auriventer Thomas	Mirador, below Baños, upper Pastaza R., Ecuador
auriventer nimbosus Anthony	San Antonio, R. Ulva, northeast slope of Mt. Tunguragua, Ecuador, 6700 ft.

[1]Bangs 1900 declared *childi* a synonym of *meridensis*.
[2]Stated by Allen (1904*a*) to be a synonym of *meridensis*.

keaysi Allen	Juliaca, Peru, 6000 ft.
obtusirostris Allen	Juliaca, Peru, 6000 ft.
pectoralis Allen	Coast of western Andes, 40 miles west of Popayan, Cauca, Colombia, 10,340 ft.
balneator balneator Thomas	Mirador, 20 miles east of Baños, eastern Ecuador
balneator hesperus Anthony	El Chiral, western Andes, Prov. El Oro, Ecuador, 5350 ft.
baroni Allen[1]	Malea, Cajabamba, Peru, 8000 ft.

Region 4 (Pacific coastal strip)

xantheolus Thomas[1]	Tumbez, northern Peru

Region 5 (central Venezuela to Trinidad)

speciosus Allen and Chapman	Princestown, Trinidad
trinitatis Allen and Chapman	Princestown, Trinidad
velutinus Allen and Chapman	Princestown, Trinidad
palmarius Allen	Quebrada Seca, Prov. Sucre, Venezuela
tenuicauda Allen	Los Palmales, Venezuela
modestus Allen	Campo Alegre, Venezuela, 5000 ft.
fulviventer Allen	Quebrada Seca, Prov. Sucre, Venezuela
klagesi Allen	El Llagual, Venezuela
helvolus Allen	Villa Vicencio, 50 miles southeast of Bogotá, Columbia, 1600 ft.
o'connelli Allen	Buenavista, 50 miles southeast of Bogotá, Colombia, 4500 ft.
vicencianus Allen	Villa Vicencio, 50 miles southeast of Bogotá, Colombia, 1500 ft.

Region 6 (Amazonia)

concolor (Wagner)	R. Curicuriari, Rio Negro, northwestern Brazil
nitidus nitidus (Thomas)	Junin and Amable Maria, Peru
goeldi Thomas	Itaitúba, Tapajoz R., Brazil
boliviæ Thomas	Mapiri, upper Beni R., Bolivia, 800 m.
perenensis Allen	Perené, Dept. Junin, Peru, 800 m.
levipes Thomas	Limbane, Dept. Puno, Peru
yunganus Thomas	Charuplaya, Securé River, just north of 16° S., Bolivia, 1350 m.
macconnelli Thomas	R. Supinaam, lower R., Essequibo, British Guiana
mureliæ Allen 1915 (new name for *incertus* Allen, 1913)	La Murelia, R. Bodoquera, Caquetá, Colombia, 600 ft.

[1]*Baroni* is probably synonymous with *xantheolus*.

polius Osgood	Tambo Carrizal, east of Balsas, Marañon R., Peru, 5000 ft.
legatus Thomas	Carapari, southern Bolivia, 1000 m.
Region 7 (Ceará to Matto Grosso)	
cephalotes (Desmarest)	Saint-Ignace Gouazou, 34½ leagues S. ¼ S. E. of Asuncion Paraguay
laticeps laticeps (Lund)	Lagoa Santa, Brazil
vulpinoides (Schinz)	Lagoa Santa, Brazil
saltator (Winge)	Lagoa Santa, Brazil
oniscus Thomas	São Lourenço, near Pernambuco, Brazil
wavrini Thomas	Jesematathla, west of Concepcion, northern Chaco of Paraguay
ratticeps paraganus Thomas	Sapucay, Paraguay
lamia Thomas	Rio Jordao, Minas Geraes, Brazil
Region 8 (south Brazil)	
angouya (Desmarest)	Wild and mountainous country of village of Atira, 50 leagues from San Ignace Gouazou, Paraguay
cinnamomeus (Pictet and Pictet)	Bahia, Brazil
ratticeps ratticeps (Hensel)	Woods. Rio Grande do Sul, Brazil
laticeps intermedia (Leche)	Brazil (probably Rio Grande do Sul)
ratticeps tropicius Thomas	Piquete, São Paulo, Brazil
Region 14 (Galapagos)	
galapagoensis (Waterhouse)	Chatham Island, Galapagos Archipelago
bauri Allen	Barrington Island, Galapagos Islands

AMERICAN MUSEUM NOVITATES

Number 581 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Nov. 14, 1932

59.9, 32 O (8)

THE TAXONOMIC HISTORY OF THE SOUTH AND CENTRAL AMERICAN ORYZOMINE GENERA OF RODENTS (EXCLUDING *ORYZOMYS*): *NESORYZOMYS, ZYGODONTOMYS, CHILOMYS, DELOMYS, PHAENOMYS, RHAGOMYS, RHIPIDOMYS, NYCTOMYS, OECOMYS, THOMASOMYS, INOMYS, AEPEOMYS, NEACOMYS* AND *SCOLOMYS*

BY G. H. H. TATE

In this fifth paper on Neotropical murine rodents I have continued my plan, introduced in the previous paper, of grouping under headings representing phytogeographic areas[1] the species belonging in larger genera. The present work should be used in connection with the previous one, which dealt with *Oryzomys* and its subgenera.

HISTORICAL STATEMENT[2]

NESORYZOMYS Heller

1899*b*. Thomas described (p. 280) *Oryzomys indefessus*, n. sp.

1904. Heller erected (p. 241) *Nesoryzomys*, n. g., with type *Nesoryzomys narboroughi*, n. sp. He removed *indefessus* Thomas from *Oryzomys* to *Nesoryzomys*.

1905. Trouessart listed *indefessus* in *Oryzomys*. Probably Heller's publication appeared too late for inclusion in the 'Catalogus.'

1929. Osgood described (p. 23) *Nesoryzomys darwini*, n. sp.

ZYGODONTOMYS Allen

1841. Lund described (p. 280) *Mus lasiurus*, n. sp.

1842. Wagner described (p. 361) *Hesperomys arviculoides* (n. sp.) and *Hesperomys orobinus* (n. sp.).

1843. Wagner added to his preliminary description of (p. 519) *arviculoides* and (p. 533) *orobinus*.

---

[1]See Map, p. 15.

[2]A copy of the newly published 'A Manual of Neotropical Sigmodont Rodents,' by Nils Gyldenstolpe (Kungl. Svenska Vetenskapsakad. Handlingar, (3) XI, No. 3, pp. 1–164 and plates, 1932) has just been received. This work should be consulted for each cricetid genus. It reached my hands too late to receive treatment under the generic headings.

1845. Wagner described (p. 147) *Hesperomys brachyurus* (n. sp.), suggesting its probable identity with *lasiurus* Lund.
1850. Wagner supplemented his earlier description of (p. 313) *brachyurus*, comparing it with *arviculoides* and *orobinus*.
1893. Allen and Chapman described (p. 215) *Oryzomys brevicauda*, n. sp.
1894. Thomas described (p. 358) *Oryzomys microtinus*, n. sp.
1895. Allen described (p. 329) *Oryzomys cherriei*, n. sp.
1897. Allen and Chapman described (p. 20) *Akodon frustrator*, n. sp., based upon two juveniles. I believe these animals to be the young of *Zygodontomys brevicauda*.
1897*a*. J. A. Allen erected (p. 38) *Zygodontomys*, n. g., with type *Oryzomys cherriei* Allen. He also referred *Oryzomys brevicauda* Allen and Chapman to *Zygodontomys*.
1897. Thomas described (p. 496) *Akodon fuscinus*, n. sp., which he compared with *lasiurus* (see Thomas, 1913).
1898*b*. Thomas described (p. 269) *Zygodontomys brunneus*, n. sp. He commented upon (p. 270) the diagnostic characters of the genus and removed *microtinus* from *Oryzomys* to *Zygodontomys*.
1898. Trouessart listed (p. 532) only *cherriei* and *brevicauda* (shown again under *Oryzomys*, p. 524). *Microtinus* and *brunneus* were shown in the appendix (p. 1327). *Lasiurus* was listed, (p. 536) in *Akodon* and *arviculoides*, *orobinus*, and *brachyurus* in *Oryzomys*.
1899*c*. Thomas described (p. 380) *Zygodontomys stellæ*, n. sp.
1899. J. A. Allen described (p. 207)*Oryzomys sanctæmartæ*, n. sp.
1900. Bangs thought that (p. 95) *Oryzomys phæopus obscurior* (a *Melanomys*) belonged in *Zygodontomys*. He suggested that *Oryzomys sanctæmartæ* Allen might be nearly the same as *phæopus obscurior*.
1900*b*. Thomas described (p. 274) *Zygodontomys brevicauda tobagi*, n. subsp.
1901*a*. J. A. Allen described (p. 39)*Zygodontomys thomasi*, n. sp.
1901. Bangs described (p. 642) *Zygodontomys seorsus*, n. sp.
1902. Bangs placed (p. 37) *Oryzomys chrysomelas* (a *Melanomys*) in *Zygodontomys*.
1902. Thomas suggested (p. 61) that *brachyurus* Wagner and *lasiurus* Lund were really *Zygodontomys*.
1905. Trouessart listed in *Zygodontomys* (p. 423) *cherriei*, *brevicauda*, "*tobagoi*," *seorsus*, *microtinus*, *brunneus*, *thomasi*, *stellæ*, and *expulsus* (the last a *Hesperomys*.)

1910*b*. Thomas listed (p. 501) *lasiurus* Lund under *Zygodontomys.*

1912. Goldman described (p. 8) *Zygodontomys cherriei ventriosus,* n. subsp.

1912. Osgood wrote (p. 52) of *Zygodontomys:* "Although formerly associated with *Oryzomys* the species of this genus seem to have much in common with *Akodon.* . . . ."

1913. Thomas described (p. 405) *Akodon arviculoides montensis,* n. subsp. Since there is no reason to doubt that Thomas had an *Akodon* before him when he described *montensis,* I have reserved that name for treatment under *Akodon.* True *arviculoides* I consider was probably a *Zygodontomys.* He stated (p. 408) that *fuscinus* and *Akodon meridensis* were both *Zygodontomys.* The latter however is truly an *Akodon.*

1913. J. A. Allen described (p. 599) *Zygodontomys griseus,* n. sp., and *Zygodontomys fraterculus,* n. sp.

1916. J. A. Allen described (p. 528) *Zygodontomys tapirapoanus,* n. sp.

1916*a*. Thomas grouped (p. 337) *Zygodontomys* with the *Akodon*-like genera.

1920. Goldman seemed more or less to subscribe to Thomas's (1916) conclusion by placing *Zygodontomys* directly after *Scotinomys,* one of the akodont genera.

1924. Miller apparently did not support Thomas's views, for he placed (p. 364) *Zygodontomys* after *Oryzomys* and *Neacomys* and quite remote from *Scotinomys.*

Chilomys Thomas

1895*b*. Thomas described (p. 368) *Oryzomys instans,* n. sp.

1897. Thomas erected (p. 500) *Chilomys,* n. g., with type *Oryzomys instans.*

1898. Trouessart listed (p. 529) *Chilomys instans.*

1905. Trouessart again listed (p. 424) *Chilomys instans.*

1912. Osgood described (p. 53) *Chilomys fumeus,* n. sp., and remarked upon the characters of the genus.

Delomys Thomas

1842. Wagner described (p. 362) *Hesperomys subflavus* (n. sp.).[1]

1843. Wagner further described (p. 534) *Hesperomys subflavus.*

1872. Hensel described (p. 42) *Hesperomys dorsalis,* n. sp.

---

[1]Inclusion of *subflavus* in *Delomys* is purely tentative

1886. Leche, remarking upon *dorsalis*, wrote (p. 696) that the species belonged to Baird's subgenus *Oryzomys*. He briefly described (p. 696) *Hesperomys dorsalis* var. *obscura* (n. var.).

1898. Trouessart listed (p. 537) *dorsalis* and *d. obscura* under *Akodon*, but did not mention *subflavus*

1901*d*. Thomas suggested (p. 528) that "*laticeps*" Winge, and "*vulpinus*" Lund (re-named *vulpinoides* by Schinz) were synonyms of *subflavus* Wagner. Both were treated under *Oryzomys* (in American Museum Novitates, No. 579).

1902. Thomas remarked (p. 60) upon *dorsalis obscura* Leche.

1903. Thomas described (p. 240) *Oryzomys sublineatus*, n. sp.

1905. Trouessart listed (p. 420) *sublineatus* and (p. 421) *subflavus* in *Oryzomys* and (p. 434) *dorsalis*[1] and its subspecies in *Akodon*.

1905. Ribeiro recorded (p. 174) *dorsalis* under "*Hesperomys*."

1906. Thomas listed (p. 443) *dorsalis* and *sublineatus* under *Thomasomys*.

1917*b*. Thomas erected (p. 196) *Delomys*, n. g., with type *Hesperomys dorsalis* Hensel. He included *sublineatus* Thomas. Both were listed in *Thomasomys* in 1906.
He described (p. 197) *Delomys dorsalis collinus*, n. subsp.

PHÆNOMYS Thomas

1894. Thomas described (p. 352) *Oryzomys ferrugineus*, n. sp.

1898. Trouessart listed (p. 525) *ferrugineus* in *Oryzomys*.

1905. Trouessart again listed (p. 419) *ferrugineus* under *Oryzomys*.

1906. Thomas listed (p. 443) *ferrugineus* under *Thomasomys*.

1917*b*. Thomas erected (p. 196) *Phænomys*, n. g., with type *Oryzomys ferrugineus* Thomas.

RHAGOMYS Thomas

1886*a*. Thomas described (p. 250) *Hesperomys rufescens*, n. sp., remarking that its nearest ally was *bicolor* Tomes (an *Œcomys*) and that for the present he would leave both in *Rhipidomys*.

1898. Trouessart listed (p. 520) *rufescens* in *Rhipidomys*.

1905. Trouessart again listed (p. 410) *rufescens* in *Rhipidomys*.

1917*b*. Thomas erected (pp. 192–193) *Rhagomys*, n. g., with type *Hesperomys rufescens* Thomas.

RHIPIDOMYS Tschudi

1826. Wied described *Mus pyrrhorhinus* (n. sp.), stated by Thomas (1886) to be an *Oryzomys*, but apparently a true *Rhipidomys*.

1841. Lund described[2] (pp. 240, 276) *Mus mastacalis* (on p. 276 the

---

[1]He held that *Hesperomys dorsalis obscura* Leche was preoccupied by *Mus* (*Habrothrix*) *obscurus* Waterhouse, and proposed for it the new name *lecheri*.
[2]For translation into German see Isis, 1843, XXXVI, pp. 738–760.

spelling appears "*mustacalis*" and in Isis, p. 750, it is changed to "*mystacalis*"), "distinguished by its tail being terminally tufted and its extremely long vibrissæ."

1843. Wagner put (p. 531) *pyrrhorhinus* in *Hesperomys* (*Calomys*). Lund's animals (pp. 544, 545) were not placed.

1844. Tschudi published (p. 252) the names *Rhipidomys* (n. subg.) and *R. leucodactylus* (n. sp.) without descriptions. *Leucodactylus* was a *nomen nudum.*

1845. Tschudi (1844) erected (p. 183) *Rhipidomys*, n. subg., to contain *Hesperomys* (*Rhipidomys*) *leucodactylus*, n. sp.

1845. Wagner described (p. 147) *Hesperomys leucodactylus* (n. sp.) from Rio Parana, Brazil (preoccupied (?) by *leucodactylus* Tschudi).

The publication of *Hesperomys leucodactylus* Wagner may well antedate that of *Rhipidomys leucodactylus* Tschudi. Wagner's name appears on p. 147 of the 383-page volume of the Archiv für Naturg., II, 1845, or less than half-way through it. While according to Sherborn, 'Index Animalium . . . ,' 1801– 1850, I, p. cxxiv, the 4th Lieferung of 'Fauna Peruana' (pp. 133–188), containing Tschudi's description of *leucodactylus*, appeared about the middle of 1845.

1850. Wagner further described (p. 310) his *leucodactylus*,—"the tail . . . is scaled, or commonly covered with brown hairs, which forms a weak brush at the tip." This character of the tail leads me to think that Wagner's animal was a *Rhipidomys*.

1854. Burmeister placed (p. 172) *pyrrhorhinus* to *Hesperomys* (*Calomys*).

1855. Burmeister (1854) mentioned (p. 7) "*mystacalis*" and *pyrrhorhinus* under *Hesperomys* (*Calomys*).

1855. Gervais described (p. 111) *Mus* (*Hesperomys*) *macrurus* (n. sp.).

1858. Tomes recorded "*Hesperomys longicaudatus*" from Ecuador. See Tomes, 1860.

1860. Tomes described (p. 213) *Hesperomys latimanus*, n. sp., and (p. 217) *Hesperomys bicolor*, n. sp., this latter being his "*longicaudatus*" of 1858 (removed later to *Œcomys*). He proposed (p. 220) a distinct group for *latimanus* and *bicolor*, and defined it (p. 221) under group "F" which, however, he gave no name. His definition applied fairly well to *Rhipidomys*.

1882. Thomas recorded in his account of Stolzmann's Peruvian collection (p. 106) "*leucodactylus*" (in the synonymy of which he

placed *latimanus*); he also described two specimens of "*pyrrhorhinus*," at the same time pointing out discrepancies between the two descriptions—his own and the original of Wied.

He described (p. 108) "*H.* (*Rhipidomys*) *cinereus*, n. sp." and (p. 109) "*H.* (*Rhipidomys*) *taczanowskii*, n. sp.," both of which in 1884 were removed by Coues to *Thomasomys*. So, evidently at that time he thought (see p. 108) that *Rhipidomys* was equal to *Nyctomys* plus *Rhipidomys* (including *Thomasomys*).

1884. Thomas, outlining the scope and characters of the subgenus *Rhipidomys*, listed (p. 448) *leucodactylus* (type), *latimanus*, *pyrrhorhinus*, *sumichrasti* (a *Nyctomys*), and doubtfully *bicolor* (an *Œcomys*).

1884. Coues removed (p. 1275) *cinereus* and *taczanowskii* to *Thomasomys*.

1886*a*. Thomas described (p. 250) *Hesperomys rufescens*, n. sp. (a *Rhagomys*), remarking that its nearest ally was *bicolor* (an *Œcomys*) and that for the present, although they were atypical, he would leave them both in *Rhipidomys*.

1886*b*. Thomas decided (pp. 421–422) on the basis of two immature specimens that *pyrrhorhinus* was not a *Rhipidomys* but an *Oryzomys*.

For the Peruvian animals referred by him (1882) to "*pyrrhorhinus*" he proposed *Hesperomys pyrrhonotus*, new name, at the same time referring the species to *Thomasomys* instead of to *Rhipidomys* and comparing it with *cinereus*.

He had been convinced by correspondence with Winge that *mastacalis* and true *pyrrhonotus* were quite distinct species. He stated that *macrurus* and *mastacalis* were true *Rhipidomys*.

1887. Winge discussed (p. 54) *Rhipidomys mastacalis* very fully, treating *Rhipidomys* as a full genus.

1887. Thomas described (p. 152) *Hesperomys* (*Rhipidomys*) *sclateri*, n. sp.

1893. Ihering, probably following Thomas (1886), listed *pyrrhorhinus* under *Hesperomys* (*Oryzomys*).

1893. Goeldi referred to *pyrrhorhinus* under "*Hesperomys*," employing no subgeneric divisions.

1893. Allen and Chapman described (p. 211) "*Tylomys couesi*," n. sp. (a *Rhipidomys*).

1894. True described (p. 688) *Sitomys* (*Rhipidomys*) *decolorus*, n. sp. (a *Nyctomys*).

1896*a*. Thomas listed (p. 1020) *Rhipidomys* as a full genus.

1896*b*. Thomas described (p. 303) *Rhipidomys venezuelæ*, n. sp. (p. 304) *Rhipidomys microtis*, n. sp., and (p. 304) *Rhipidomys fulviventer*.

1897. Allen and Chapman removed *couesi* from *Tylomys*, where it had been placed erroneously (1893), to *Rhipidomys*.

1897*b*. J. A. Allen listed (p. 51) *sumichrasti* under *Rhipidomys*.

1897. Palmer pointed out (p. 106) that the name *Rhipidomys* dated not from Tschudi's 'Fauna Peruana' but from his 'Mammalium Conspectus,' Archiv für Naturg., I, 1844, p. 252. This was true, but *Rhipidomys* of the 'Conspectus' included only *leucodactylus* Tschudi, which remained a *nomen nudum* until the appearance of the description in 'Fauna Peruana.'

1898. Trouessart made the following allocations: *pyrrhorhinus* was returned from *Oryzomys* (Thomas, 1886, and Ihering, 1893) to *Rhipidomys; leucodactylus* Wagner (1845) became a synonym of *mastacalis;* following Allen's views, *Nyctomys* was retained in the synonymy of *Rhipidomys; decolorus* (True) (a *Nyctomys*) was removed from "*Sitomys*" to *Rhipidomys*.

1899*c*. Thomas described (p. 378) *Rhipidomys marmosurus*, n. sp. (removed in 1906 to *Œcomys*).

1900*a*. Thomas described (p. 152) *Rhipidomys venustus*, n. sp.

1900*b*. Thomas described (p. 270) *Rhipidomys goodfellowi*, n. sp., *Rhipidomys venezuelæ cumananus*, n. subsp., and *Rhipidomys dryas*, n. sp. (the last removed in 1906 to *Œcomys*).

1900. DeWinton described (p. 52) *Rhipidomys macconnelli*, n. sp. (removed in 1917 to *Thomasomys*).

1901*a*. Thomas described (p. 181) *Rhipidomys phæotis*, n sp. (removed in 1906 to *Œcomys*).

1901*b*. Thomas described (p. 369) *Rhipidomys benevolens*, n. sp. (in 1906 made type of *Œcomys*).

1901*c*. Thomas described (p. 148) *Rhipidomys nitela*, n. sp.

1901*b*. J. A. Allen described (p. 43) *Rhipidomys ochrogaster*, n. sp.

1902. Bangs pointed out (p. 30) the distinctiness of *Nyctomys* from *Rhipidomys*.

1903. Thomas described (p. 237) *Rhipidomys roberti*, n. sp. (removed in 1906 to *Œcomys*).

1904*a*. Thomas described (p. 34) *Rhipidomys venezuelæ fervidus*, n. subsp., and (p. 35) *Rhipidomys rosilla*, n. sp. (the latter removed in 1906 to *Œcomys*).

1904*b*. Thomas described (p. 193) *Rhipidomys pictor*, n. sp., and (p. 194) *Rhipidomys paricola*, n. sp. (the latter removed in 1906 to *Œcomys*).

1905. Trouessart listed (pp. 409–410), in addition to those species belonging there, a series of mice under *Rhipidomys* which were removed by Thomas (1906) to *Œcomys*. He retained *Nyctomys* in the synonymy of *Rhipidomys*.

1906. Thomas, after discussing the characters of the subgenus *Rhipidomys*, divided it into two subgenera: *Rhipidomys*, and *Œcomys*, n. subg., with *Rhipidomys benevolens* Thomas type of the latter.

In the restricted *Oryzomys* (*Rhipidomys*) he retained (p. 444) *leucodactylus, mastacalis, macrurus, latimanus, ochrogaster, couesi, sclateri, goodfellowi, venezuelæ, venustus, microtis, pictor, nitela,* and *fulviventer*.

Macconnelli, transferred in 1917 to *Thomasomys*, was held to be an aberrant form of *Rhipidomys*.

1910*b*. Thomas described (p. 501) *Rhipidomys cearanus*, n. sp.

1911*a*. Thomas described (p. 114) *Rhipidomys bovallii*, n. sp., and *Rhipidomys lucullus*, n. sp.

1912. J. A. Allen described (p. 78) *Rhipidomys mollissimus*, n. sp., *Rhipidomys similis*, n. sp., and *Rhipidomys cocalensis*, n. sp.

1913. Goldman described (p. 8) *Rhipidomys scandens*, n. sp.

1913. J. A. Allen described (p. 600) *Rhipidomys quindianus*, n. sp., (p. 601) *Rhipidomys caucensis*, n. sp., (p. 601) *Rhipidomys venezuelæ yuruanus*, n. subsp., and (p. 602) *Rhipidomys milleri*, n. sp.

1914*a*. Osgood described (p. 140) *Rhipidomys fulviventer elatturus*, n. subsp.

1915. Thomas described (p. 312) *Rhipidomys equatoris*, n. sp.

1917*b*. Thomas removed *rufescens* (1886) to become type of *Rhagomys* and removed (p. 196) *macconnelli* to *Thomasomys*. He rediagnosed *Rhipidomys*, listing twenty-nine species.

1921*a*. Thomas described (p. 183) *Rhipidomys austrinus*, n. sp.

1925. Thomas described (p. 578) *Rhipidomys collinus*, n. sp.

1926*b*. Thomas described (p. 161) *Rhipidomys modicus*, n. sp.

1927*b*. Thomas described (p. 600) *Rhipidomys rex*, n. sp.

NYCTOMYS[1] de Saussure

1860. De Saussure described (pp. 98, 107–108) *Hesperomys sumichrasti* (n. sp.), placing it in a "group" of *Hesperomys*, which he named *Nyctomys*.

1861. Tomes described (p. 284) *Myoxomys*, n. subg. of *Hesperomys*, placing in it *Hesperomys* (*Myoxomys*) *salvini*, n. sp. He also referred (p. 284) the two Ecuadorian *Rhipidomys*, *latimanus* and *bicolor*, to *Myoxomys*.

1880. Alston placed (p. 143) *Myoxomys* in the synonymy of *Nyctomys* and treated the latter as a subgenus of *Hesperomys* (*sensu lato*).

1882. Thomas considered (p. 108) that *Nyctomys* (and *Myoxomys*) should be included in *Rhipidomys*.

1884. Thomas, reviewing the subgenera of "*Hesperomys*," placed (p. 448) *sumichrasti* (a *Nyctomys*) under *Rhipidomys*.

1894. True described (p. 689) *Sitomys* (*Rhipidomys*) *decolorus*, n. sp. He thought (p. 690) *salvini* distinct from *sumichrasti*.

1897*b*. J. A. Allen listed (p. 51) *sumichrasti* under *Rhipidomys*.

1898. Trouessart listed *Nyctomys* as a synonym of *Rhipidomys*. He made *salvini* a synonym of *sumichrasti*.

1902. Bangs described (p. 30) *Nyctomys nitellinus*, n. sp. He pointed out the distinctness of *Nyctomys* from *Rhipidomys*.

1903. Bangs remarked further (p. 158) upon *decolorus* and *nitellinus*.

1905. Trouessart still held (p. 409) *Nyctomys* to be a synonym of *Rhipidomys*.

1906. Thomas pointed out (p. 445) a dental character of *Nyctomys* distinguishing it from *Rhipidomys* and "possibly" relating it to *Peromyscus*.

1908. J. A. Allen treated (p. 658) *salvini* as a *Rhipidomys*.

1916. Goldman described (p. 155) *Nyctomys sumichrasti venustulus*, n. subsp.

1924. Miller made (p. 368) all forms subspecies of *sumichrasti*.

1927*a*. Thomas, in 'Lectotypes of American Rodents,' named (p. 548) B.M.7.1.1.93, male, from Dueñas, Guatemala, lectotype of *Nyctomys salvini* and 7.1.1.91, 92, 94 lectoparatypes.

---

[1]Description of a form allied to *Nyctomys*, which represents a new genus and species, is in course of publication by H. E. Anthony.

Œcomys Thomas

1844. Pictet and Pictet described (p. 67) *Mus maculipes* (probably an *Œcomys*).[1]

1860. Tomes described (p. 217) *Hesperomys bicolor*, n. sp.

1898. Trouessart listed (p. 520) *bicolor* under *Rhipidomys*, and (p. 528) "*musculipes*" (=*maculipes*) under *Oryzomys*.

1899*c*. Thomas described (p. 378) *Rhipidomys marmosurus*, n. sp.

1900*b*. Thomas described (p. 271) *Rhipidomys dryas*, n. sp.

1901*a*. Thomas described (p. 181) *Rhipidomys phæotis*, n. sp.

1901*b*. Thomas described (p. 369) *Rhipidomys benevolens*, n. sp.

1903. Thomas described (p. 237) *Rhipidomys roberti*, n. sp.

1904*a*. Thomas described (p. 35) *Rhipidomys rosilla*, n. sp.

1904*b*. Thomas described (p. 194) *Rhipidomys paricola*, n. sp.

1905. Trouessart listed in *Rhipidomys* (pp. 409–410) the series removed in 1906 by Thomas to *Œcomys*.

1906. Thomas erected (p. 444) *Œcomys*, n. subg. of *Oryzomys* with type *Rhipidomys benevolens* Thomas, to contain a number of species hitherto included in the subgenus *Rhipidomys: bicolor, dryas, benevolens, marmosurus, phæotis, paricola, rosilla*, and *roberti*.

He described (p. 445) *Oryzomys* (*Œcomys*) *mamoræ*, n. sp.

1909*a*. Thomas described (p. 376) *Œcomys tapajinus*, n. sp., and raised (p. 379) *Œcomys* to the rank of a full genus.

1909*b*. Thomas described (p. 234) *Œcomys catherinæ*, n. sp., a rather aberrant form.

1910*a*. Thomas described (p. 187) *Œcomys guianæ*, n. sp.

1910*c*. Thomas described (p. 504) *Œcomys rex*, n. sp., and (p. 505) *Œcomys nitedulus*, n. sp.

1911*b*. Thomas described (p. 250) *Œcomys superans*, n. sp., and (p. 251) *Œcomys palmeri*, n. sp.

1913. J. A. Allen described (p. 603) *Œcomys mincæ*, n. sp., and (p. 603) *Œcomys caicaræ*, n. sp.

1916. J. A. Allen described (p. 523) *Œcomys milleri*, n. sp., (p. 524) *Œcomys florenciæ*, n. sp., and (p. 525) *Œcomys emiliæ*, n. sp.

1921. Anthony described (p. 4) *Œcomys rutilus*, n. sp.

1923. G. M. Allen and T. Barbour described (p. 262) *Œcomys trabeatus*, n. sp.

1924. Thomas described (p. 287) *Œcomys osgoodi*, n. sp.

---

[1]This allocation is provisional. The description is quite like *Oecomys;* the figure perhaps more like *Oryzomys*.

1924. Anthony described (p. 4) *Œcomys melleus*, n. sp.
1927*b*. Thomas further remarked (p. 601) upon *Œcomys osgoodi*.

THOMASOMYS Coues

1860. Tomes described (p. 219) *Hesperomys aureus*, n. sp.

1882. Thomas referred (p. 107) certain specimens to "*pyrrhorhinus* Wied" (see Thomas, 1886) and described (p. 108) *Hesperomys (Rhipidomys) cinereus*, n. sp., and (p. 109) *Hesperomys (Rhipidomys) taczanowskii*, n. sp.

1884. Thomas, reviewing the subgenera of *Hesperomys*, included (p. 449) *cinereus* and *taczanowskii* in *Vesperimus* Coues (a synonym of *Peromyscus* Gloger).

1884. Coues erected (p. 1275) *Thomasomys*, n. subg., to contain *cinereus* and *taczanowskii*, designating *cinereus* the type.

1886*b*. Thomas proposed (p. 422) *pyrrhonotus*, new name for the Peruvian rats previously referred by him (1882) to *Rhipidomys pyrrhorhinus* of Brazil. At the same time he compared *pyrrhonotus* with *cinereus* and placed it in *Thomasomys* Coues.

1894. Thomas temporarily rejected (p. 350) *Thomasomys* as only doubtfully worthy of retention and described (p. 349) *Oryzomys kalinowskii*, n. sp., (p. 350) *Oryzomys incanus*, n. sp. (an *Inomys*), and (p. 352) *Oryzomys ferrugineus*, n. sp. (a *Phænomys*).

1895*a*. Thomas described (p. 58) *Oryzomys princeps*, n. sp., and (p. 59) *Oryzomys laniger*, n. sp.

1896*b*. Thomas described (p. 305) *Oryzomys niveipes*, n. sp.

1898*a*. Thomas described (p. 453) *Thomasomys paramorum*, n. sp., and (p. 454) *Oryzomys vestitus*, n. sp.

1898*c*. Thomas remarked (p. 318) upon additional characters visible in the newly remade skin of *vestitus*.

1898. Trouessart made (pp. 512–519) *Thomasomys* a subgenus of *Peromyscus*, but raised it again to full generic rank (Appendix, p. 1324). He moved into it *kalinowskii* and *incanus* (from *Oryzomys*, and also *lugens* (but see Appendix, p. 1317, where he listed *lugens* in *Aepeomys*).

1899*a*. Thomas described (p. 152) *Oryzomys bæops*, n. sp.

1900*c*. Thomas described (p. 354) *Oryzomys prætor*, n. sp., and remarked upon the small group of *Oryzomys* comprising *aureus* and *princeps* (i.e., *Thomasomys*).

1900. Bangs erected (p. 96) *Erioryzomys*, n. subg. of *Oryzomys* with

type *Oryzomys* (*Erioryzomys*) *monochromos*, n. sp. The relationship to *O. laniger* Thomas was pointed out. *Erioryzomys* is a synonym of *Thomasomys*.

1905. Trouessart listed (p. 408) *cinereus*, *taczanowskii*, *pyrrhonotus*, *kalinowskii*, *incanus* (an *Inomys*), and *paramorum*.

Under *Erioryzomys* he placed (p. 423) *monochromos* and *laniger*, suggesting in a footnote that *bæops*, *niveipes*, *vestitus*, *villosus* (an *Oryzomys*), etc., also belonged there.

Aureus Tomes was still listed (p. 419) in *Oryzomys*. By error he cited Nelson instead of Bangs as author of *Erioryzomys monochromos*.

1906. Thomas, after discussing the anatomical and taxonomic characters of *Thomasomys* and placing *Erioryzomys* Bangs in its synonymy (pp. 443–444), listed the species which he thought should be included in the genus. In addition to the six species given by Trouessart (1905) and the two (*laniger* and *monochromos*) formerly in *Erioryzomys* Bangs, he included *vestitus*, *bæops*, and *niveipes*, three of the four pro posed for transfer to *Erioryzomys* by Trouessart (1905, p. 423), but he omitted *villosus*, the fourth species. He transferred the two species *prætor* and *auritus* from *Oryzomys* to *Thomasomys* and also *ferrugineus*, *dorsalis*, and *sublineatus* of eastern Brazil. The last three are no longer considered as *Thomasomys*.

He stated (p. 444) that *macconnelli* (transferred to *Thomasomys* 1917) was aberrant from typical *Rhipidomys*.

1912. Osgood described (p. 50) *Thomasomys hylophilus*, n. sp.

1912. J. A. Allen described (p. 80) *Thomasomys cinereiventer*, n. sp., and *Thomasomys popayanus*, n. sp.

1914. J. A. Allen described (p. 200) *Thomasomys aureus altorum*, n. subsp.

He thought that the type locality of *aureus* ought to be assumed as Pallatanga, Ecuador. It was probably higher up the mountains than Pallatanga proper, whose altitude is only 4400 ft.

1914. Stone described (p. 12) *Thomasomys rhoadsi*, n. sp.

1914*b*. Osgood described (p. 162) *Thomasomys cinereus ischyrus*, n. subsp.

He pointed out (p. 163) the close similarity between *Thomasomys* and *Peromyscus*.

1916*b*. Thomas described (p. 479) *Thomasomys laniger emeritus*, n. subsp.

1917*a*. Thomas described (p. 2) *Thomasomys notatus*, n. sp., *Thomasomys gracilis*, n. sp., and *Thomasomys daphne*, n. sp.

1917*b*. Thomas spoke (p. 192) of *Erioryzomys* Bangs as comprising "*Rhipidomys* and *Thomasomys*." This was hardly correct, since Bangs (1900) based his genus upon two species, *monochromos* and *laniger*, both *Thomasomys*. Thomas re-characterized (p. 195) *Thomasomys* (giving *Erioryzomys* as a synonym). He listed only twenty-two species, having now removed *ferrugineus* to *Phænomys*, n. g., *dorsalis* and *sublineatus* to *Delomys*, n. g., and *incanus* to *Inomys*, n. g. *Macconnelli* was transferred to *Thomasomys* from *Rhipidomys*.

1921. Lönnberg listed (p. 38) *pichinchius* (a *nomen nudum*).

1921*b*. Thomas described (p. 355) *Thomasomys nicefori*, n. sp.

1921*c*. Thomas doubted (p. 233) the validity of *aureus altorum* Allen and discussed (p. 234) the systematic position of *notatus*.

1923. Anthony described (p. 3) *Thomasomys hudsoni*, n. sp., (p. 4) *Thomasomys caudivarius*, n. sp., and (p. 6) *Thomasomys auricularis*, n. sp.

1924. Anthony described (p. 2) *Thomasomys sylvestris*, n. sp.

1924. Anthony described (p. 5) *Thomasomys cinnameus*, n. sp., and (p. 6) *Thomasomys rhoadsi fumeus*, n. subsp.

1925. Anthony described (p. 1) *Thomasomys bombycinus*, n. sp., (p. 2) *Thomasomys cinereiventer dispar*, n. subsp., (p. 3) *Thomasomys cinereiventer contradictus*, n. subsp., and (p. 4) *Thomasomys daphne australis*, n. subsp.

1926*a*. Thomas raised (p. 613) *cinereus ischyrus* Osgood to full specific rank and described *Thomasomys ischyrus eleusis*, n. subsp.

1926*c*. Thomas described (p. 347) *Thomasomys rosalinda*, n. sp.

1926*a*. Anthony described (p. 1) *Thomasomys ladewi*, n. sp., and (p. 2) *Thomasomys oreas*, n. sp.

1926*b*. Anthony described (p. 5) *Thomasomys erro*, n. sp.

1927*a*. Thomas listed (p. 549) B.M.81.9.7.23, a female skinned from spirit, from Tambillo, Peru, lectotype of *Thomasomys taczanowskii* and 81.9.7.22, lectoparatype.

1927*b*. Thomas described (p. 602) *Thomasomys fraternus*, n. sp.

1928. Thomas described (p. 154) *Thomasomys œnax*, n. sp. This species, the only one known from Brazil, he referred to the *cinereus* section of the genus.

1932. Anthony described (p. 1) *Thomasomys ottleyi*, n. sp.

Inomys Thomas

1894. Thomas described (p. 350) *Oryzomys incanus*, n. sp.
1898. Trouessart listed (p. 519) *incanus* as a *Thomasomys*.
1905. Trouessart again placed (p. 409) *incanus* in *Thomasomys*.
1906. Thomas listed (p. 443) *incanus* under *Thomasomys*.
1917*b*. Thomas erected (p. 197) *Inomys*, n. g., with type *Oryzomys incanus* Thomas.

Æpeomys Thomas

896*b*. Thomas described (p. 306) *Oryzomys lugens*, n. sp.
1898*a*. Thomas erected (p. 452) *Æpeomys*, n. g., with type *Oryzomys lugens*.
He described *Æpeomys vulcani*, n. sp.
1898. Trouessart listed *Æpeomys* in the Appendix (p. 1327).
1905. Trouessart gave (p. 424) *Æpeomys* full generic rank.
1912. J. A. Allen described (p. 89) *Æpeomys fuscatus*, n. sp.
1914. Stone corrected (p. 11) Thomas's measurement of the tail of *vulcani*.

Neacomys Thomas

1882. Thomas described (p. 105) *Hesperomys* (*Calomys*) *spinosus*, n. sp.
1884. Thomas, reviewing the subgenera of *Hesperomys*, removed (p. 448) *spinosus* to the subgenus *Oryzomys*.
1898. Trouessart listed (p. 528) *spinosus* under *Oryzomys*.
1900*a*. Thomas erected (p. 153) *Neacomys*, n. g., with type *Hesperomys* (*Calomys*) *spinosus* Thomas ("*Oryzomys spinosus*") and described (p. 153) *Neacomys spinosus tenuipes*, n. subsp.
1903. Thomas described (p. 239) *Neacomys spinosus amœnus*, n. subsp.
1905. Trouessart listed (p. 423) *Neacomys spinosus* and *Neacomys spinosus tenuipes*. *N. spinosus amœnus* was not recorded.
1905. Thomas described (p. 310) *Neacomys guianæ*, n. sp.
1912. Goldman described (p. 6) *Neacomys pictus*, n. sp.
1912. J. A. Allen described (p. 81) *Neacomys pusillus*, n. sp.
He suggested (p. 82) that his animals of the Inca Mines, Peru, belonged to a well-marked form of *N. spinosus*.
1927*a*. Thomas named (p. 548) B.M.81.9.7.25, a male in spirit from Huambo, Peru, lectotype of *Neacomys spinosus*, and 81.9.7.26, lectoparatype.

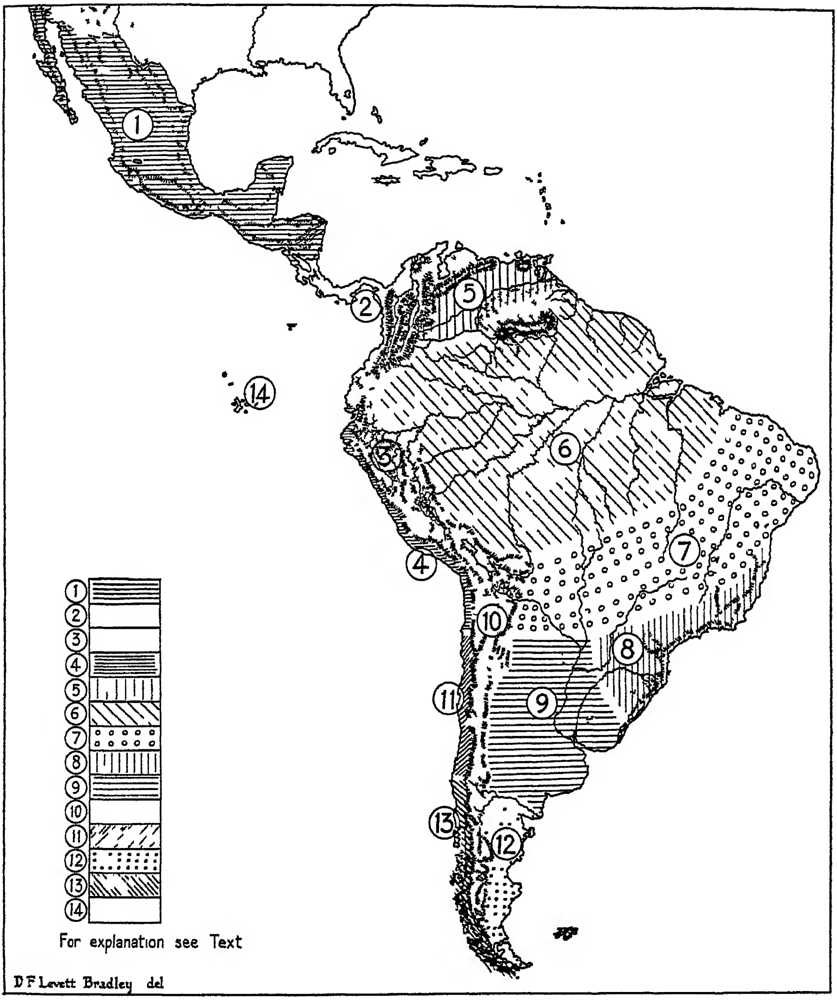


Fig. 1 Map to show phytogeographical areas of Central and South America. For full definitions see original in American Museum Novitates, No. 579, pp. 12–14.

Scolomys Anthony

1924. Anthony erected (p. 1) *Scolomys*, n. g., with type *Scolomys melanops*, n. sp. (p. 2).

PRESENT STATUS OF THE GENERA

Genus *Nesoryzomys* Heller	Type by original designation: *Nesoryzomys narboroughi* Heller
Genus *Zygodontomys* Allen	Type by original designation: *Oryzomys cherriei* Allen
Genus *Chilomys* Thomas	Type by original designation and monotypy: *Oryzomys instans* Thomas
Genus *Delomys* Thomas	Type by original designation: *Hesperomys dorsalis* Hensel
Genus *Phænomys* Thomas	Type by original designation and monotypy: *Oryzomys ferrugineus* Thomas
Genus *Rhagomys* Thomas	Type by original designation and monotypy: *Hesperomys rufescens* Thomas
Genus *Rhipidomys* Tschudi	Type by monotypy: *Rhipidomys leucodactylus* Tschudi[1]
Genus *Nyctomys* de Saussure (=*Myoxomys* Tomes)	Type by monotypy: *Hesperomys* (*Nyctomys*) *sumichrasti* de Saussure
Genus *Œcomys* Thomas	Type by original designation: *Rhipidomys benevolens* Thomas
Genus *Thomasomys* Coues (=*Erioryzomys* Bangs)	Type by original designation: *Hesperomys* (*Rhipidomys*) *cinereus* Thomas
Genus *Inomys* Thomas	Type by original designation and monotypy: *Oryzomys incanus* Thomas
Genus *Æpeomys* Thomas	Type by original designation and monotypy: *Oryzomys lugens* Thomas
Genus *Neacomys* Thomas	Type by original designation: *Hesperomys* (*Calomys*) *spinosus* Thomas
Genus *Scolomys* Anthony	Type by original designation and monotypy: *Scolomys melanops* Anthony

List of Named Forms with Type Localities

Nesoryzomys

indefessus (Thomas)	Indefatigable Island, Galapagos Islands
narboroughi Heller	Narborough Island, Galapagos Islands
darwini Osgood	Academy Bay, Indefatigable Island, Galapagos Islands

Zygodontomys

It will be seen that I have suggested inclusion of the old names *lasiurus*, *orobinus*, *arviculoides*, and *brachyurus* in this genus. Not only

[1]Should *leocodactylus* Wagner, whose description agrees with *Rhipidomys*, be shown to have been published before *leucodactylus* Tschudi, the latter, although type of the genus, will require a new name.

do the measurements and brief descriptions given by the authors of these names tally closely with *Zygodontomys*, but the genus actually exists in the Brazilian dry belt (*tapirapoanus* Allen). It seems not improbable that the five names now extant for the south Brazilian members of this savanna-frequenting genus may eventually be reduced through synonymy to a single one—*lasiurus* Lund.

Region 2 (north and northwest of Andes, and Panama and Costa Rica)[1]

cherriei cherriei (Allen)	Boruca, Costa Rica
cherriei ventriosus Goldman	Tabernilla, Canal Zone, Panama
brunneus Thomas	El Saibal, western Cundinamarca, Colombia
seorsus Bangs	San Miguel Island, Panama
griseus Allen	El Triunfo, Magdalena Valley, Colombia 600 ft.
fraterculus Allen	Chicoral, Rio Coello, Tolima, Colombia 1800 ft.
sanctaemartae Allen	Bonda, Santa Marta district, Colombia

Region 5 (Orinoco and Trinidad)

brevicauda brevicauda (Allen and Chapman)	Indian Walk Rest-House, 7 miles from Princestown, Trinidad (*fide* Chapman)
brevicauda tobagi Thomas	Isl. Tobago
stellæ Thomas	Maipures, upper Orinoco, Venezuela
thomasi Allen	Campo Alegre, 90 miles south of Cumana, Venezuela

Region 6 (Amazonia)

microtinus (Thomas)	Surinam
fuscinus (Thomas)	Marajó Island, mouth of Amazon River, Brazil

Region 7 (northeastern Brazil through Matto Grosso)

lasiurus (Lund)	Lagoa Santa, Brazil
arviculoides (Wagner)	Brazil
tapirapoanus Allen	Tapirapoan, R. Sepotuba, Matto Grosso, Brazil

Region 8 (southern Brazil)

orobinus (Wagner)	Ypanema, Brazil
brachyurus (Wagner)	Ytararé, Brazil

Chilomys

instans (Thomas)	Bogotá, Colombia
fumeus Osgood	Paramo de Tama, head of Tachira R., Santander, Colombia, 6000–7000 ft.

Delomys

[1]See Map, p. 15. For fuller definitions of the phytogeographic regions employed see Part 1 of paper on *Oryzomys* (Amer. Mus. Novit., No. 579, 1932, pp. 12–14).

Delomys represents a local oryzomine radiation in southern Brazil of moderate-sized rats closely allied to *Oryzomys*, which are characterized by possessing a distinct blackish mid-dorsal longitudinal stripe which diffuses on either side into the yellowish brown of the general body color.

Subflavus is provisionally placed in this genus on the basis of Wagner's description of 1843. The yellowish brown pelage and black mid-dorsal stripe are quite suggestive of *Delomys*. The dimensions are approximately correct, but the tail length given for *subflavus* is rather longer than that of *dorsalis collinus*.

subflavus (Wagner)	Brazil
dorsalis dorsalis (Hensel)	Rio Grande do Sul, Brazil
dorsalis collinus Thomas	Itatiaya, Rio de Janeiro, Brazil, 4800 ft.
dorsalis obscura (Leche)	Brazil (probably in Rio Grande do Sul)
sublineatus (Thomas)	Engenheiro Reeve, Inland of Victoria, Prov. Espiritu Santo, Brazil, 500 m.

Phænomys

ferrugineus (Thomas)	Rio de Janeiro, Brazil

Rhagomys

rufescens (Thomas)	Rio de Janeiro, Brazil

Rhipidomys

A large genus of arboreal, *Oryzomys*-like rats, with long, more or less brush-tipped tails, which live in forest and gallery woods in the tropics and subtropics. It seems to be represented in Central America by *Nyctomys*.

Region 2 (north and west of Andes, and Panama)

latimanus (Tomes)	"the greater portion believed . . . collected at Pallatanga . . . but the exact locality is not certain," Ecuador
venezuelæ venezuelæ Thomas	Mérida, Venezuela, 5000 ft.
microtis Thomas	Salina de Vatan, western Cundinamarca, Colombia
fulviventer fulviventer Thomas	Agua Dulce, western Cundimarca, Colombia
venustus Thomas	Las Vegas del Chama, Mérida, Venezuela
pictor Thomas	Rio Verde, northwestern Ecuador, 1000 m.
mollissimus Allen	Miraflores, near Palmira, west slope of Central Andes, Cauca, Colombia, 6200 ft.
similis Allen	Cocal, Cauca, Colombia, 6000 ft.
cocalensis Allen	Cocal, Cauca, Colombia, 6000 ft.
scandens Goldman	R. Limon, Mt. Pirri, eastern Panama, 5000 ft.
equatoris Thomas	Santo Domingo, western Ecuador, 1600 ft.

Region 3 (Andes, above 6000 ft.)

quindianus Allen	El Roble, central Andes, Colombia, 7200 ft.
caucensis Allen	Munchique, western Andes, Cauca, Colombia, 8225 ft.
fulviventer elatturus Osgood	Paramo de Tama, head of R. Tachira, Venezuela, 7000 ft.

Region 5 (central Venezuela and Trinidad)

couesi (Allen and Chapman)	Princestown, Trinidad
venezuelæ cumananus Thomas	Ipure, Cumaná, Venezuela, 600 ft.
venezulæ fervidus Thomas	La Union, R. Caura, lower Orinoco, Venezuela
venezuelæ yuruanus Allen	R. Yuruan, eastern Venezuela.

Region 6 (Amazonia and Guiana mountains)

leucodactylus (Tschudi)	Subtropics of eastern Andes, Peru (in Chirimoya field)
sclateri (Thomas)	Maccassema, British Guiana
goodfellowi Thomas	Mouth of R. Coca, upper R. Napo, Ecuador
nitela Thomas	Kwaımattat, Kanuku Mts., British Guiana
ochrogaster Allen	Inca Mines, Peru, 6000 ft.
bovallii Thomas	Potaro Highlands, towards Mt. Roraima, British Guiana, 2000 ft.
lucullus Thomas	Garita del Sol, Valley of Vitoc, upper Perené R., Peru
milleri Allen	Minnehaha Creek, lower Essequibo River, Briitsh Guiana, 500 ft.
modicus Thomas	Puca Tambo, 50 miles east of Chachapoyas Peru, 5100 ft.
rex Thomas	Chinchavita, Huanuco, Peru, 3000 ft.

Region 7 (northeastern Brazil and Matto Grosso)

mastacalis (Lund)	Lagoa Santa, Brazil
macrurus (Gervais)	"près á Trixas, en mai 1844." This is a misprint for Crixas, north of Goyaz, Prov. Goyaz, Brazil, visited by Castelnau and Deville May 8–10, 1844 ('Exped. Amer. Sud-Histoire du Voyage,' 1850, I, pp. 356–359)
cearanus Thomas	Serra de Ibiapaba, Prov. Céara, Brazil
austrinus Thomas	Sunchal, Sierra de Santa Barbara, southeastern Jujuy, Argentina
collinus Thomas	Sierra Santa Rosa, S. Bolivia, 1000 m.

Region 8 (southern Brazil)

pyrrhorhinus (Wied)	Hinterland of the Capitania da Bahia, Brazil

Nyctomys

sumichrasti sumichrasti (Saussure)	Eastern slope of the cordillera, Vera Cruz, Mexico
sumichrasti salvini (Tomes)	Dueñas, Guatemala
sumichrasti decolorus (True)	Rio de las Piedras, Honduras
sumichrasti nitellinus Bangs	Boquete, Panama
sumichrasti venustulus Goldman	Greytown, Nicaragua

Œcomys

The genus *Œcomys* is even more closely restricted to the lowlands than is *Rhipidomys*, the greatest altitude reached probably not exceeding 5000 feet.

Region 2 (North and West of Andes, and Panama)

dryas (Thomas)	Paramba, northeastern Ecuador
mincæ Allen	Minca, Santa Marta region, Colombia, 2000 ft.
trabeatus Allen and Barbour	Rio Jesuito, eastern Panama

Region 5 (Orinoco and Trinidad)

marmosurus (Thomas)	Maipures, upper Orinoco, Venezuela
rosilla (Thomas)	La Union, R. Caura, lower Orinoco, Venezuela
caicaræ Allen	Caicara, R. Orinoco, Venezuela

Region 6 (Amazonia and Guiana mountains)

bicolor (Tomes)	Gualaquiza, eastern Ecuador
benevolens (Thomas)	Chimote,[1] 68° W., 15° S., upper Beni R., Bolivia, 700 m.
phæotis (Thomas)	Segrario, 13° 5′ S., 70° 5° W., upper Inambari R., southeastern Peru, 1000 m.
tapajinus Thomas	Santa Rosa, R. Tamauchim, right bank of upper R. Tapajoz, Brazil
guianæ Thomas	R. Supinaam, lower R. Essequibo, British Guiana
rex Thomas	R. Supinaam, lower R. Essequibo, British Guiana
nitedulus Thomas	Demarara, 13 miles from mouth of R. Essequibo, British Guiana
superans Thomas	Canelos, R. Bobonaza, eastern Ecuador, 2100 ft.
palmeri Thomas	Canelos, R. Bobonaza, eastern Ecuador, 2100 ft.
florenciæ Allen	Florencia, R. Caquetá, Colombia, 675 ft.
rutilus Anthony	Kartabo, British Guiana
osgoodi Thomas	Moyobamba, northern Peru, 2700 ft.
melleus Anthony	Zamora, eastern Ecuador, 3250 ft.

[1]Probably a misspelling of Chimate.

Region 7 (northeastern Brazil through Matto Grosso)

paricola (Thomas)	Igarapé Assu, near Pará, Brazil
roberti (Thomas)	Santa Anna de Chapada, 30 miles northeast of Cuyaba, Matto Grosso, Brazil
mamoræ Thomas	Mostenes, upper Mamoré River, Yungas, Bolivia
milleri Allen	Barão Melgaço, Matto Grosso, Brazil
emiliæ Allen	R. Mojú, Pará, Brazil

Region 8 (southern Brazil)

catherinæ Thomas	Joinville, Santa Catherina, southern Brazil
maculipes (Pictet and Pictet)	Bahia region, Brazil

Thomasomys

Region 3 (Andes, above 6000 ft.)

aureus aureus (Tomes)	"believed . . . Pallatanga, western slope of Cordillera; but the exact locality is not certain." Ecuador
aureus altorum Allen	Mt. Pichincha, Ecuador, 11,000 ft.
cinereus (Thomas)	Cutervo, Prov. Chota, Dept. Cajamarca, Peru, 9000 ft.
taczanowskii (Thomas)	Tambillo, R. Malleta, tributary of R. Marañon, Peru, 5700 ft.
pyrrhonotus (Thomas)	Tambillo, R. Malleta, tributary of R. Marañon, Peru, 5700 ft.
kalinowskii (Thomas)	Valley of Vitoc, eastern central Peru
princeps (Thomas)	Bogotá, Colombia
laniger (Thomas)	Bogotá, Colombia
niveipes (Thomas)	La Oya del Burro, western Cundinamarca, Colombia
paramorum Thomas	Paramo, south of Chimborazo, Ecuador
vestitus (Thomas)	Rio Milla, Mérida, Florida
bæops (Thomas)	R. Pita, above Chillo Valley, Ecuador
prætor (Thomas)	Eastern slopes of paramo, between San Pablo and Cajamarca, Peru
hylophilus Osgood	Paramo de Tama, head of R. Tachira, Venezuela
cinereiventer cinereiventer Allen	Crest of western Andes, 40 miles west of Popayan, Cauca, Colombia
cinereiventer dispar Anthony	Andalucia, eastern Andes, Huila, Colombia, 7000 ft.
cinereiventer contradictus Anthony	Santa Isabel, Quindio Andes, Colombia, 12,700 ft.
popayanus Allen	Crest of western Andes, 40 miles west of Popayan, Cauca, Colombia
rhoadsi rhoadsi Stone	Hacienda Garzon, Mt. Pichincha, Ecuador, 10,500 ft.

rhoadsi fumeus Anthony	Hacienda San Francisco, east of Ambato, Ecuador, 8000 ft.
ischyrus ischyrus Osgood	Tambo Almirante, near Uchco, upper R. Mayo, Peru
ischyrus eleusis Thomas	Tambo Jenes, between Cajamarca and Chachapoyas, N. Peru, 12,000 ft.
laniger emeritus Thomas	Montes de Escaguer, Mérida, Venezuela, 2500 m.
notatus Thomas	Torontoy, Peru, 9500 ft.
gracilis Thomas	Matchu Picchu, Peru, 12,000 ft.
daphne Thomas	Ocobamba Valley, Peru, 9100 ft.
daphne australis Anthony	Incachaca, Cochabamba, Bolivia, 7700 ft.
nicefori Thomas	San Pedro, north of Medellin, Colombia
hudsoni Anthony	Bestion, Prov. Azuay, Ecuador, 10,100 ft.
caudivarius Anthony	Taraguacocha, Cord, de Chilla, Prov. El Oro, Ecuador, 10,750 ft.
auricularis Anthony	Taraguacocha, Cord. de Chilla, Prov. El Oro, Ecuador, 10,750 ft.
sylvestris Anthony	Las Maquinas, Santa Domingo trail, west of Corazon, western Andes, Ecuador, 7000 ft.
cinnameus Anthony	Hacienda San Francisco, east of Ambato, Ecuador, 8000 ft.
bombycinus Anthony	Paramillo, western Andes, Colombia, 12,500 ft.
rosalinda Thomas	Goncha, Amazonas, northern Peru, 8500 ft.
ladewi Anthony	Rio Aceramarca, northeast of La Paz, Bolivia, 10,800 ft.
oreas Anthony	Cocopunco, about 80 miles north of La Paz, Bolivia, 10,000 ft.
erro Anthony	Mt. Sumaco, Rio Suno, R. Napo, eastern Ecuador. Between 8000–9000 ft.?
fraternus Thomas	Alcas, 25 miles northeast of Cerro, Junin, 11,500 ft.
ottleyi Anthony	Paramo de los Conejos, about 15 miles north of Mérida, Venezuela, 9600 ft.
monochromos Bangs	Paramo de Macotama, Sierra Nevada de Santa Marta, Colombia, 11,000 ft.

Region 5 (Venezuela and Guiana mountains)

macconnelli (de Winton)	Mt. Roraima, Brazil, 8600 ft.

Region 8 (southern Brazil)

œnax Thomas	San Lourenço, Rio Grande do Sul, Brazil

Inomys

incanus (Thomas)	Valley of Vitoc, eastern central Peru

Æpeomys

lugens (Thomas)	La Loma del Morro, near Mérida, Venezuela
vulcani Thomas	Mount Pichincha, Ecuador, 12,000 ft.

fuscatus Allen	San Antonio, near Cali, Cauca, Colombia, 7000 ft.
Neacomys	
spinosus spinosus (Thomas)	Huambo, R. Huambo, tributary of R. Huallaga, Peru, 3700 ft.
spinosus tenuipes Thomas	Guaquimay, near Bogotá, Colombia
spinosus amœnus Thomas	Santa Anna de Chapada, 30 miles northeast of Cuyaba, Matto Grosso, Brazil
guianæ Thomas	Demarara R., British Guiana
pictus Goldman	Cana, eastern Panama, 1800 ft.
pusillus Allen	San José, Cauca, Colombia
Scolomys	
melanops Anthony	Mera, Pastaza Valley, eastern Ecuador, 3800 ft.

LIST OF REFERENCES

Allen, G. M., and Barbour, T. 1923. Bull. Mus. Comp. Zoöl., LXV.

Allen, J. A. 1895. Bull. Amer. Mus. Nat. Hist., VII, p. 329.

1897*a*. Bull. Amer. Mus. Nat. Hist., IX, pp. 31–44.

1897*b*. Bull. Amer. Mus. Nat. Hist., IX, pp. 47–58.

1899. Bull. Amer. Mus. Nat. Hist., XII, pp. 195–218.

1900. Bull. Amer. Mus. Nat. Hist., XIII, p. 225.

1901*a*. Bull. Amer. Mus. Nat. Hist., XIX, pp. 39–40.

1901*b*. Bull. Amer. Mus. Nat. Hist., XIX, pp. 41–46.

1908. Bull. Amer. Mus. Nat. Hist., XXIV, pp. 647–670.

1912. Bull. Amer. Mus. Nat. Hist., XXXI, pp. 71–95.

1913. Bull. Amer. Mus. Nat. Hist., XXXII, pp. 597–604.

1914. Bull. Amer. Mus. Nat. Hist., XXXIII, pp. 199–200.

1916. Bull. Amer. Mus. Nat. Hist., XXXV, pp. 523–530.

Allen, J. A., and Chapman, F. M. 1893. Bull. Amer. Mus. Nat. Hist., V, pp. 203–234.

1897. Bull. Amer. Mus. Nat. Hist., IX, pp. 13–30.

Alston, E. R. 1880. 'Biologia Centrali-Americana.' Mammalia.

Anthony, H. E. 1921. Amer. Mus. Novit., No. 19.

1923. Amer. Mus. Novit., No. 55.

1924. Amer. Mus. Novit., No. 114.

1925. Amer. Mus. Novit., No. 178.

1926*a*. Amer. Mus. Novit., No. 239.

1926*b*. Amer. Mus. Novit., No. 240.

1932. Amer. Mus. Novit., No. 548.

Bangs, O. 1900. Proc. N. England Zool. Club, I, pp. 87–102.

1901. Amer. Nat., XXXV, pp. 631–644.

1902. Bull. Mus. Comp. Zoöl., XXXIX, pp. 17–51.

1902. Bull. Mus. Comp. Zoöl., XXXIX, pp. 141–159.

Burmeister, H. 1854. 'Syst. Uebersicht der Thiere Brasiliens.'

1855. Abh. Naturf. Ges. Halle, II (1), (1854).

Coues, E.	1884.	Amer. Nat., XVIII, pp. 1275–1276.
Gervais, P.	1855.	'Animaux nouv. ou rares . . . l'Amerique du Sud . . . '—Mammiferes.
Goeldi, E. A.	1893.	'Os Mammiferos do Brasil.'
Goldman, E. A.	1912.	Smiths. Misc. Coll., LVI, No. 36.
	1913.	Smiths. Misc. Coll., LX, No. 22.
	1916.	Proc. Biol. Soc. Wash., XXIX, pp. 155–156.
	1920.	Smiths. Misc. Coll., LXIX, No. 5.
Heller, E.	1904.	Calif. Ac. Sci., (3) III.
Hensel, R.	1872.	Abh. k. Akad. Wiss. Berlin, p. 42.
Ihering, H. von.	1893.	'Os Mammiferos do Rio Grande do Sul.' Annuario do Estado do Rio Grande do Sul, para o anno 1893, de Graciano A. de Azambuja.
Leche, W.	1886.	Zool. Jahrb., I, pp. 687–700.
Lönnberg, E.	1921.	Arkiv. f. Zool., XIV, No. 4.
Lund, P. W.	1841.	Selskabs. k. danske, Vid. Skrifter, (4) VIII.
Miller, G. S., Jr.	1924.	Bull. U. S. Nat. Mus., CXXVIII.
Osgood, W. H.	1912.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 33–66.
	1914*a*.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 135–141.
	1914*b*.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 143–185.
	1929.	Field Mus. Nat. Hist., Zool. Ser., XVII, pp. 21–24.
Palmer, T. S.	1897.	Science, (2) VI.
Pictet, F.-J., and Pictet, C.	1844.	'Notices sur les animaux nouveaux ou peu connus du Musee de Genève,' pp. 41–82 (separately published by Soc. Phys. Hist. Nat. Genève).
Ribeiro, A. de Miranda.	1905.	Arch. Mus. Nac. Rio de Janeiro, XIII, pp. 174–175.
Stone, W.	1914.	Proc. Ac. Nat. Sci. Phila., pp. 9–19.
Thomas, O.	1882.	Proc. Zool. Soc. London, pp. 98–111.
	1884.	Proc. Zool. Soc. London, pp. 447–458.
	1886*a*.	Ann. Mag. Nat. Hist., (5) XVII, pp. 250–251.
	1886*b*.	Ann. Mag. Nat. Hist., (5) XVIII, pp. 421–423.
	1887.	Proc. Zool. Soc. London, pp. 150–152.
	1894.	Ann. Mag. Nat. Hist., (6) XIV, pp. 346–366.
	1895*a*.	Ann. Mag. Nat. Hist., (6) XVI, pp. 55–60.
	1895*b*.	Ann. Mag. Nat. Hist., (6) XVI, pp. 367–370.

THOMAS, O.

1896*a*. Proc. Zool. Soc. London, pp. 1012–1028.
1896*b*. Ann. Mag. Nat. Hist., (6) XVIII, pp. 301–314.
1897. Ann. Mag. Nat. Hist., (6) XIX, pp. 454–501.
1898*a*. Ann. Mag. Nat. Hist., (7) I, pp. 451–457.
1898*b*. Ann. Mag. Nat. Hist., (7) II, pp. 265–275.
1898*c*. Ann. Mag. Nat. Hist., (7) II, pp. 318–320.
1899*a*. Ann. Mag. Nat. Hist., (7) III, pp. 152–155.
1899*b*. Ann. Mag. Nat. Hist., (7) IV, pp. 278–288.
1899*c*. Ann. Mag. Nat. Hist., (7) IV, pp. 378–383.
1900*a*. Ann. Mag. Nat. Hist., (7) V, pp. 148–153.
1900*b*. Ann. Mag. Nat. Hist., (7) V, pp. 269–274.
1900*c*. Ann. Mag. Nat. Hist., (7) V, pp. 354–357.
1901*a*. Ann. Mag. Nat. Hist., (7) VII, pp. 179–190.
1901*b*. Ann. Mag. Nat. Hist., (7) VII, pp. 366–371.
1901*c*. Ann. Mag. Nat. Hist., (7) VIII, pp. 139–154.
1901*d*. Ann. Mag. Nat. Hist., (7) VIII, pp. 526–536.
1902. Ann. Mag. Nat. Hist., (7) IX, pp. 59–64.
1903. Proc. Zool. Soc. London, II, pp. 232–244.
1904*a*. Ann. Mag. Nat. Hist., (7) XIV, pp. 33–37.
1904*b*. Ann. Mag. Nat. Hist., (7) XIV, pp. 188–196.
1905. Ann. Mag. Nat. Hist., (7) XVI, pp. 308–314.
1906. Ann. Mag. Nat. Hist., (7) XVIII, pp. 442–448.
1909*a*. Ann. Mag. Nat. Hist., (8) III, pp. 378–380.
1909*b*. Ann. Mag. Nat. Hist., (8) IV, pp. 230–242.

Thomas, O.
1910*a*. Ann. Mag. Nat. Hist., (8) VI, pp. 184–189.
1910*b*. Ann. Mag. Nat. Hist., (8) VI, pp. 500–503.
1910*c*. Ann. Mag. Nat. Hist., (8) VI, pp. 503–506.
1911*a*. Ann. Mag. Nat. Hist., (8) VII, pp. 113–115.
1911*b*. Ann. Mag. Nat. Hist., (8) VIII, pp. 250–256.
1913. Ann. Mag. Nat. Hist., (8) XI, pp. 404–409.
1915. Ann. Mag. Nat. Hist., (8) XVI, pp. 310–312.
1916*a*. Ann. Mag. Nat. Hist., (8) XVIII, pp. 336–340.
1916*b*. Ann. Mag. Nat. Hist., (8) XVIII, pp. 478–480.
1917*a*. Smiths. Misc. Coll., LXVIII, No. 4.
1917*b*. Ann. Mag. Nat. Hist., (8) XX, pp. 192–198.
1921*a*. Ann. Mag. Nat. Hist., (9) VII, pp. 183–187.
1921*b*. Ann. Mag. Nat. Hist., (9) VIII, pp. 354–357.
1921*c*. Proc. U. S. Nat. Mus., LVIII, pp. 217–249.
1924. Ann. Mag. Nat. Hist., (9) XIV, pp. 286–288.
1925. Ann. Mag. Nat. Hist., (9) XV, pp. 575–582.
1926*a*. Ann. Mag. Nat. Hist., (9) XVII, pp. 610–616.
1926*b*. Ann. Mag. Nat. Hist., (9) XVIII, pp. 156–167.
1926*c*. Ann. Mag. Nat. Hist., (9) XVIII, pp. 345–349.
1927*a*. Ann. Mag. Nat. Hist., (9) XIX, pp. 545–554.
1927*b*. Ann. Mag. Nat. Hist., (9) XX, pp. 594–608.
1928. Ann. Mag. Nat. Hist., (10) I, pp. 154–155.

Tomes, R. F.
1858. Proc. Zool. Soc. London, pp. 546–549.
1860. Proc. Zool. Soc. London, pp. 211–221.
1861. Proc. Zool. Soc. London, pp. 278–288.

Trouessart, E.-L.
1898. 'Cat. Mamm. viv. foss.'
1905. 'Cat. Mamm. viv. foss.,' Supplement.

True, F. W.	1894.	Proc. U. S. Nat. Mus., XVI.
Tschudi, J. J. von.	1844.	Arch. f. Naturg., I.
	1845.	'Fauna Peruana,' (1844).
Wagner, A.	1842.	Arch. f. Naturg., I, pp. 356–362.
	1843.	Schreber's 'Saugethiere,' Supplement III.
	1845.	Arch. f. Naturg., I, pp. 145–149.
	1850.	Abh. Math.-Phys. Classe, Akad. Wiss., V, pp 306–317.
Wied, M.	1826.	Beitrage z. Naturg. Brasilien, II.
Winge, H.	1887.	E. Mus. Lundii, I (pt. 3).
DeWinton, W. E.	1900.	Trans. Linn. Soc., (2) VIII, p. 52.

AMERICAN MUSEUM NOVITATES

Number 580 | Published by The American Museum of Natural History New York City | Nov. 14, 1932

59 9,32 O (8)

THE TAXONOMIC HISTORY OF THE SOUTH AND CENTRAL AMERICAN CRICETID RODENTS OF THE GENUS *ORYZOMYS*.—PART 2: SUBGENERA *OLIGORYZOMYS, THALLOMYSCUS, AND MELANOMYS*

By G. H. H. Tate

The present paper, Part 2 of the fourth of my papers on the Cricetidæ, is a direct continuation of and should be considered in conjunction with Part 1 (on the subgenus *Oryzomys*).

HISTORICAL STATEMENT[1]

Oryzomys Baird

Subgenus **Oligoryzomys** Bangs

1801. Azara described (p. 98) RAT SIXIÈME OU RAT A TARSE NOIR, probably an *Oligoryzomys*.

1802. Azara described further (p. 91) the above species under the name COLILARGO.

1819. Desmarest applied (p. 64) the name *Mus nigripes* (n. sp.) to Azara's RAT A TARSE NOIR.

1830. Rengger described (p. 232) *Mus longitarsus* (n. sp.) (apparently an *Oligoryzomys*).

1832. Bennett described (p. 2) *Mus longicaudatus* (n. sp.).

1835. Bennett described (p. 191) *Mus magellanicus* (n. sp.). The dimensions given by Bennett seem too large for *Oligoryzomys*, but Thomas (1927*a*) treated it as such.

1837. Waterhouse described (p. 19) *Mus flavescens*. He placed it in none of his four subgenera of *Mus* (*Calomys*, *Phyllotis*, etc.).

1839. Waterhouse remarked further (p. 46) upon *flavescens* and added descriptions of *longicaudatus* and *magellanicus*. They were placed in the blanket genus *Hesperomys* (p. 74).

1841. Lund described (p. 279) "*Mus longicaudatus*," preoccupied by *longicaudatus* Bennett. His description however agrees well with *Oligoryzomys*.

[1] A copy of the newly published 'A Manual of Neotropical Sigmodont Rodents,' by Nils Gyldenstolpe (Kungl. Svenska Vetenskapsakad. Handlingar, (3) XI, No 3, pp. 1–164 and plates, 1932), has just been received. This work should be consulted for each cricetid genus. It reached my hands too late to receive treatment under the generic headings.

1843. Wagner placed (p. 529) *longicaudatus* and (p. 530) *flavescens* in *Hesperomys* (*Calomys*).
1843. Bridges wrote (p. 129) of *longicaudatus* in the Quillota Valley, Chile.
1845. Tschudi described (p. 182) *Hesperomys destructor* (n. sp.) and *H. melanostoma* (n. sp.). Both have the general appearance of *Oligoryzomys*, the former having the tail shorter, the latter longer than the body. Both were placed by Tschudi in *Hesperomys* (*Hesperomys*).
1845. Wagner described (p. 147) *Hesperomys eliurus* (n. sp.) and *pygmæus* (n. sp.).
1848. Peale described (p. 51) *Mus peruvianus*, n. sp.
1850. Wagner thought (p. 309) *eliurus* near *longicaudatus* Bennett and identical with *longicaudatus* Lund. He further described *pygmæus*.
1854. Burmeister re-characterized (p. 173) *eliurus* under *Hesperomys* (*Calomys*).
1855. Burmeister (1854) briefly discussed (p. 7) *longicaudatus*, *eliurus*, and *flavescens*.
1858. Philippi and Landbeck described (p. 80) *Mus philippii* (n. sp.), determined by Wolffsohn (1910) to be a synonym of *longicaudatus* Bennett.
1858. Cassin placed *peruvianus* Peale in the synonymy of *Drymomys parvulus* (=*Mus musculus?*).
1859. Baird erected *Oryzomys*, subgenus of *Hesperomys*.
1860*a*. Tomes described (p. 215) *Hesperomys minutus*, n. sp.
1860. De Saussure described (pp. 102–108) *Hesperomys fulvescens* (n. sp.).
1872. Hensel gave (p. 37) additional information about *flavescens*.
1881. Thomas described (p. 4) *Hesperomys* (*Calomys*) *coppingeri*, n. sp.
1882. Thomas received (p. 104) "*longicaudatus*" from Peru (later renamed *stolzmanni*).
1883. Pelzeln wrote concerning *eliurus* and *pygmæus*.
1884. Thomas removed most of the South American *Oryzomys* from *Calomys* and placed them in *Oryzomys* (including *Oligoryzomys*) as now understood.
1886. Leche wrote of (p. 694) *flavescens*.
1887. Winge wrote in detail (p. 46) upon "*Calomys longicaudatus*."
1890. Coues raised (p. 4164) *Oryzomys* to full generic rank.
1891. Thomas in Milne-Edwards made additional remarks (p. 26) upon *coppingeri* and (p. 27) "*longicaudatus*."

1893. Goeldi wrote of *eliurus, pygmæus,* and *flavescens* under *Hesperomys.*
1893. Ihering placed *flavescens* under subgenus *Calomys.*
1893. J. A. Allen described (p. 239) *Oryzomys costaricensis,* n. sp.
1894. Ihering gave (p. 19) only "*longicaudatus*" of the genus *Oryzomys* under *Hesperomys* (*Calomys*), and synonymized *flavescens, pygmæus,* and *eliurus* with it.
1894. Thomas described (p. 357) *Oryzomys stolzmanni,* n. sp. (see Thomas, 1882). He compared *stolzmanni* with *longicaudatus* and "*minutus.*" (This last was re-described as *dryas* in 1898.)
1894. Figuera remarked upon "*Hesperomys*" *flavescens.*
1897. Allen and Chapman described (p. 19) *Oryzomys delicatus,* n. sp.
1897*d*. J. A. Allen listed (p. 204) *fulvescens* in *Oryzomys,* commenting on its near relationship to *costaricensis.*
1898*a*. Thomas described (p. 178) *Oryzomys victus,* n. sp.
1898*c*. Thomas described (p. 267) *Oryzomys dryas,* n. sp. (now in *Thallomyscus*), based upon a skin from Pallatanga, Ecuador, which was referred by him in 1884 to *minutus.*
1898. Trouessart listed all *Oligoryzomys* under *Oryzomys.*
1899. Bangs described (p. 9) *Oryzomys navus,* n. sp.
1900. Philippi described about seventy forms of mice under the genus *Mus,* the following six of which were synonymized by Wolffsohn (1910) with *longicaudatus: philippii, macrocercus, nigribarbis, saltator, amblyrrhynchus, diminutivus.*
1900. Bangs erected (p. 94) *Oligoryzomys,* n. subg. of *Oryzomys,* to contain the small species usually called "pygmy oryzomys," with type *Oryzomys navus* Bangs. He included *dryas humilior* Thomas (a *Thallomyscus*).
1901*a*. Thomas described (p. 151) *Oryzomys navus messorius,* n. subsp. (see Allen, 1911).
1901*b*. Merriam fixed (p. 295) the type locality of *fulvescens.*
1902. Thomas stated (p. 60) that *pygmæus* was a juvenile specimen of *eliurus.*
1902. Bangs listed (p. 35) *costaricensis* and *vegetus,* n. sp., under *Oryzomys* (*Oligoryzomys*).
1904*a*. J. A. Allen described (p. 328) *Oryzomys tenuipes,* n. sp.
1905. J. A. Allen re-described (p. 46) *longicaudatus* Bennett, remarking that "*longicaudatus*" Thomas in Milne-Edwards (1890) was probably *magellanicus.*
1905. Trouessart listed in *Oligoryzomys,* subgenus, (p. 442): *navus*

navus messorius, *fulvescens*, *costaricensis*, *minutus*, *minutus humilior*, *dryas*, and *vegetus*.

1909. Lyon and Osgood stated (p. 289) that the type of *peruvianus* was lost.

1910. J. A. Allen described (p. 100) *Oryzomys* (*Oligoryzomys*) *nicaraguæ*, n. sp.

1910. Wolffsohn synonymized six of Philippi's (1900) names with *longicaudatus* Bennett.

1911. J. A. Allen stated (p. 253) that *delicatus* was an *Oligoryzomys* and raised (p. 254) *navus messorius* Thomas (1901) to full specific rank.

1912. Osgood described (p. 49) *Oryzomys griseolus*, n. sp.

1912. J. A. Allen described (p. 85) *Oryzomys* (*Oligoryzomys*) *munchiquensis*, n. sp., and (p. 86) *Oryzomys* (*Oligoryzomys*) *fulvirostris*, n. sp.

1913*b*. Thomas described (p. 571) *Oryzomys arenalis*, n. sp.

1914. Stone traced (p. 10) the history of *Oryzomys minutus* (Tomes).

1914*b*. Osgood described (p. 155) *Oryzomys stolzmanni maranonicus*, n. subsp., and *Oryzomys andinus*, n. sp. He remarked (p. 154) upon *stolzmanni*, (p. 156) *arenalis* and *peruvianus* (Peale), and (p. 158) *minutus* and *dryas* (both *Thallomyscus*. See Thomas, 1926).

1915. Goldman described (p. 130) *Oryzomys fulvescens lenis*, n. subsp.

1916. Osgood described (p. 205) *Oryzomys chaparensis*, n. sp., comparing it with *eliurus*.

1916. Thomas corrected the location of the type locality of *coppingeri* and mentioned the close affinity of *coppingeri* to *magellanicus*. He described (p. 186) *Oryzomys magellanicus mizurus*, n. sp.

1916*b*. J. A. Allen described (p. 525) *Oryzomys* (*Oligoryzomys*) *microtis*, n. sp., (p. 527) *Oryzomys* (*Oligoryzomys*) *utiaritensis*, n. sp., and *Oryzomys* (*Oligoryzomys*) *mattogrossæ*, n. sp.
He remarked (pp. 526–527) upon the naturalness of the *Oligoryzomys* group, concluding that it ought to remain a subgenus.

1917*a*. Thomas erected (p. 1) *Microryzomys*, n. subg., with type *Oryzomys minutus* Tomes.

1917*b*. Thomas described (p. 96) *Oryzomys delticola*, n. sp.

1918. Goldman listed (p. 17) *costaricensis* as a subspecies of *fulvescens* in Central America and described (p. 92) *fulvescens mayensis*, n. subsp. He made *nicaraguae* a synonym of *costaricensis*.

1920. Thomas remarked (p. 229) upon *Microryzomys* and stated that the type of *minutus* "shows the characters of *Microryzomys* in all respects."

1924. Miller, following Goldman (1918), listed (p. 362) *Oligoryzomys* as a subgenus of *Oryzomys*.

1926. Thomas remarked (pp. 611–612) "there seems no tangible difference between *stolzmanni* of Peru and *minutus* of Ecuador." He thought that *peruvianus* Peale, "afterwards stated by Peale himself to be synonymous with *Drymomys parvulus* Tschudi, which is certainly *Mus musculus*," should be taken as the common house mouse, and the name *arenalis* should be left valid for the Pacasmayo *Oryzomys*.

He reversed his conclusions (1920) regarding *minutus* Tomes and now declared it not a *Microryzomys*, but an *Oryzomys*, "no doubt of the *Oligoryzomys* group." But *minutus* was type of *Microryzomys*, so *Microryzomys* now became a synonym of *Oligoryzomys*.

He next proposed the [subgeneric ?] name *Thallomyscus* with type *Oryzomys dryas* Thomas; and stated that *minutus* of Tomes (an *Oligoryzomys*) was distinct from *minutus* of Osgood, 1914 (a *Thallomyscus*). He placed (p. 612) *aurillus* in *Thallomyscus*.

1927*a*. Thomas thought (p. 369) that *destructor* Tschudi should be considered a subspecies of *longicaudatus* Bennett. He believed *melanostoma* Tschudi and "the Peruvian mouse commonly called *minutus* or *stolzmanni*" to be synonymous with *longicaudatus destructor*.

1927*b*. Thomas, in his choice of lectotypes in the British Museum (pp. 548–549), selected: male, 79.8.21.15 from Cockle Cove, Patagonia, for the lectotype of *coppingeri;* and 55.12.24.174 from Port Famine, Magellan, for lectotype of *magellanicus*, with 55.12.24.337 lectoparatype.

1929. Thomas suggested (p. 38) that all the southern forms—*magellanicus, mizurus, coppingeri*—might well be subspecies of *longicaudatus*.

Subgenus THALLOMYSCUS Thomas

1894. Thomas identified (p. 357) as *minutus* (Tomes) a mouse which in 1898 he re-named *dryas*.

1898*c*. Thomas described (p. 267) *Oryzomys dryas*, n. sp., based upon the

specimen from Pallatanga referred by him in 1894 to *minutus*. He described (p. 268) *Oryzomys dryas humilior*, n. subsp.

1914*b*. Osgood discussed (p. 158) "*dryas*" (a *Thallomyscus*, according to Thomas, 1926).

1917*a*. Thomas described (p. 1) *Oryzomys* (*Microryzomys*)[1] *aurillus*, n. sp.

1926. Thomas erected (p. 613) *Thallomyscus*, n. subg. of *Oryzomys* with type *Oryzomys dryas* Thomas, and included in it *aurillus*.

1927*c*. Thomas further discussed (p. 600) *Thallomyscus aurillus*.

Subgenus MELANOMYS Thomas

1860*b*. Tomes described (p. 263) *Hesperomys caliginosus*, n. sp.

1882. Thomas discussed (p. 110) under "*caliginosus*" a rat which he referred rather doubtfully to Tomes's animal. (Probably *Akodon* (*Chalcomys*) *ærosus*).

1891*a*. J. A. Allen commented upon (p. 210) "*Hesperomys* (*Habrothrix*) *caliginosus* Tomes?" from Central America (=*chrysomelas*).

1893. Allen and Chapman referred (p. 217) a diurnal mouse of Trinidad provisionally to "*Abrothrix caliginosus*." This was an *Akodon* (*Chalcomys*).

1894. Thomas described (p. 355) *Oryzomys phæopus*, n. sp., and (p. 356) *Oryzomys phæopus obscurior*, n. subsp.

1897*a*. J. A. Allen described (p. 37) *Oryzomys chrysomelas*, n. sp. He stated that Costa Rican skins previously referred by him to *Hesperomys caliginosus* Tomes were really *Oryzomys chrysomelas* and he compared *chrysomelas* briefly with *alfaroi* (an *Oryzomys*).

1897. Allen and Chapman corrected their identification of "*Abrothrix caliginosus*" (1893) to *Akodon urichi*, n. sp.

1898. Trouessart listed (p. 523) the species of *Melanomys* under *Oryzomys*.

1899. J. A. Allen described (p. 203) *Akodon columbianus*, n. sp.

1900. Bangs removed (p. 95) *phæopus obscurior* to "*Oryzomys* (*Zygodontomys*)." He suggested that *O. sanctæmartæ* Allen (a true *Oryzomys*) was closely allied to it.

1902*c*. Thomas erected (p. 247) *Melanomys*, n. subg. of *Oryzomys*, with type *Oryzomys phæopus* Thomas.

1903. Thomas again advised (pp. 40–41) separation of *Melanomys* from *Oryzomys*.

---

[1]For history of *Microryzomys* see under *Oligoryzomys* (1917, 1920, and 1926).

1904*b*. J. A. Allen removed (p. 437) *columbianus* from *Akodon* (1899) to *Oryzomys* (*Melanomys*) and stated (p. 440) that the "*phæopus obscurior*" of Bangs equalled *columbianus* Allen.

1905. Trouessart listed (p. 422) *Melanomys* as a subgenus of *Oryzomys*. *Phæopus* with its subspecies and *chrysomelas* were the only two species given. *Caliginosus* appeared under *Akodon*.

1911. J. A. Allen listed (p. 254) *venezuelensis* Allen (an *Akodon*) under "*Oryzomys* (*Melanomys*)."

1912. Goldman described (p. 5) *Oryzomys idoneus*, n. sp.

1912. J. A. Allen listed (p. 87) *phæopus* and *obscurior* as full species and suggested that *chrysomelas* might be a subspecies of *obscurior* only slightly differentiated. He described (p. 88) *Oryzomys* (*Melanomys*) *obscurior affinis*, n. subsp.

1913*a*. Thomas remarked (p. 406) that some of the animals referred earlier by Allen and himself to *caliginosus* were *Akodon ærosus*.

1913*a*. J. A. Allen stated (p. 480) that certain species before referred to *phæopus* and *obscurior* were in reality *Akodon tolimæ*.

1913*b*. J. A. Allen revised (pp. 533–555) the *Melanomys* group, treating it as a full genus.
Obscurior and *affinis* were made full species (pp. 535, 539, 546) and the following new forms were proposed: (p. 538) *caliginosus oroensis*, n. subsp.; (p. 540) *affinis monticola*, n. subsp.; (p. 544) *phæopus vallicola*, n. subsp.; (p. 545) *phæopus tolimensis*, n. subsp.; (p. 545) *lomitensis*, n. sp.; (p. 547) *buenavistæ*, n. sp.

1914. Thomas described (p. 243) *Melanomys robustulus*, n. sp.

1918. Goldman characterized (p. 94) *Melanomys*, reducing it to a subgenus once more, and made *idoneus* and *chrysomelas* subspecies of *caliginosus*.

1924. Miller, following Goldman (1918), listed (p. 363) *Melanomys* as a subgenus of *Oryzomys*.

PRESENT STATUS OF *ORYZOMYS* AND ITS SUBGENERA

Genus *Oryzomys* Baird	Type by original designation: *Mus palustris* Harlan
Subgenus *Oryzomys* Baird	
Subgenus *Oligoryzomys* Bangs (=*Microryzomys* Thomas)	Type by original designation: *Oryzomys navus* Bangs
Subgenus *Thallomyscus* Thomas	Type by original designation: *Oryzomys dryas* Thomas
Subgenus *Melanomys* Thomas	Type by original designation: *Oryzomys phæopus* Thomas

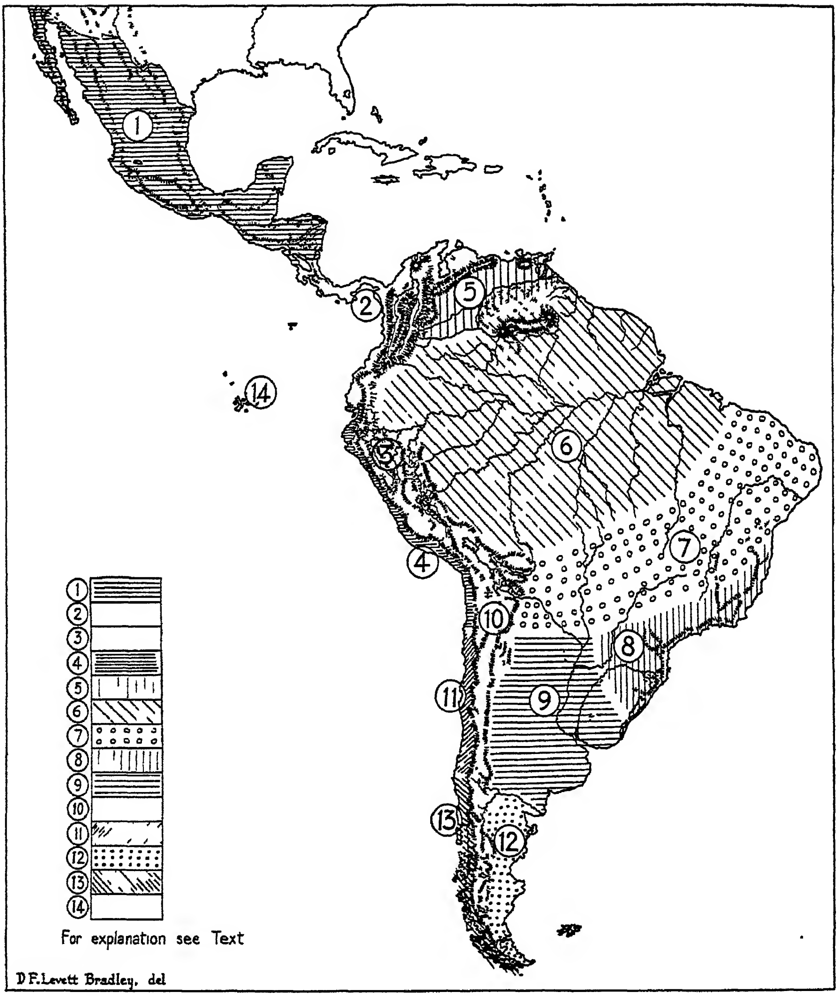


Fig. 1 Map to show phytogeographical areas of Central and South America. For full descriptions see original in American Museum Novitates, No. 579 (Part 1 of this paper).

List of Named Forms with Type Localities

As stated in Part 1 of this paper, the larger subgenera have been classed under generalized phytogeographical provinces. For convenience, the map to show these areas is reprinted herewith. For definitions of phytogeographical provinces see pp. 12–14, Part 1.

Oryzomys (*Oligoryzomys*)

Since it is as yet quite uncertain whether *Oligoryzomys* represents a natural division or is merely a polyphyletic assemblage of small forms descended from independent oryzomine stocks, I have grouped together for convenience only the names of those mice which from their small size appear to belong to *Oligoryzomys*. Concerning the validity of locating in *Oligoryzomys* the species listed for Central America and northwestern South America there can be little doubt. Thomas has intimated (1927*a* and 1929) that the Chilean and Patagonian forms should be included in the subgenus. But no statement has yet been published as to the standing in this respect of the small-sized *Oryzomys* of Paraguay, Uruguay and southern Brazil. My inclusion of the last-named mice in *Oligoryzomys*, then, is purely by way of suggestion.

Region 1 (Central America)

fulvescens fulvescens (Saussure)	Mexico (Orizaba, Vera Cruz. See Merriam, 1901)
fulvescens lenis Goldman	Los Reyes, Michoacan, Mexico
fulvescens costaricensis Allen	El General, Costa Rica, 2150 ft.
fulvescens mayensis Goldman	Apazote, Campeche, Mexico
nicaraguæ Allen[1]	Vijagua, east of Matagalpa, Nicaragua

Region 2 (north and west of the Andes, and Panama)

minutus (Tomes)	"believed . . . at Pallatanga, but the exact locality is not certain," Ecuador
fulvescens vegetus Bangs	Boquete, Chiriqui, Panama
tenuipes Allen	Mérida, Venezuela, 1630 m.

Region 3 (Andes above 6000 ft.)

destructor (Tschudi)	"The house mouse of the 'Plantagen at the border of the forest," eastern Peru
melanostoma (Tschudi)	"A field mouse . . . found in yuca and corn fields," eastern Peru
andinus Osgood	Hacienda Llagueda, upper R. Chicama, Peru; 6000 ft.

[1]Synonymized by Goldman with *fulvescens costaricensis* Allen.

navus Bangs	Pueblo Viéjo, Sierra Nevada de Santa Marta, Colombia, 8000 ft.
griseolus Osgood	Paramo de Tama, head of R. Tachira, Venezuela, 6000–7000 ft.
munchiquensis Allen	La Florida, Colombia, 7700 ft.
fulvirostris Allen	Munchique, Colombia, 8325 ft.
Region 4 (Pacific coastal strip)	
peruvianus (Peale)[1]	Callao, Peru
arenalis Thomas	Eten, coast of northwestern Peru
Region 5 (central Venezuela to Trinidad)	
delicatus Allen and Chapman	Caparo, Trinidad
victus Thomas	St. Vincent
Region 6 (Amazonia)	
stolzmanni stolzmanni Thomas	Huambo, northern Peru, 3700 ft.
stolzmanni maranonicus Osgood	Hacienda Limon, near Balsas, R. Marañon, Peru
microtis Allen	Lower R. Solimoes (50 miles above mouth) Brazil
messorius Thomas	Kanuku Mts., British Guiana
Region 7 (Ceará to Matto Grosso)	
longitarsus (Rengger)	North of Villa Real, on the banks of the Paraguay River
utiaritensis Allen	Utiarity, R. Papagaia, Matto Grosso, Brazil
mattogrossæ Allen	Utiarity, Matto Grosso, Brazil
chaparensis Osgood	Todos Santos, Chaparé R., Bolivia
Region 8 (south Brazil)	
nigripes (Desmarest)	Atira, 50 leagues from San Ignace Gouazou, Paraguay
eliurus (Wagner)	"Woods of São Paulo and Matto Grosso," Brazil
pygmæus (Wagner)	Ypanema, São Paulo, Brazil
Region 9 (Pampas)	
flavescens (Waterhouse)	Maldonado, Uruguay
delticola Thomas	Isla Ella, delta R. Parana
Region 11 (Central Provinces of Chile)	
longicaudatus (Bennett)	"In trees in Chile"
philippii (Philippi and Landbeck)[2]	In woods and fields, Chile
Region 12 (arid Patagonia)	
magellanicus magellanicus (Bennett)	Near Port Famine, Magellan
magellanicus mizurus Thomas	Koslowsky Valley, 46° S., 71° W., central Patagonia

[1] *Peruvianus* may have been *Mus musculus*.
[2] Synonym of *longicaudatus;* for other synonyms of *longicaudatus* see Philippi, 1900.

Region 13 (Patagonian rain forests)

coppingeri (Thomas)	An island in Cockle Cove, Tom Bay, Magellan. (Corrected 1916 to: Tom Bay, in the Trinidad Channel, northern end of Madre de Dios Island, western Patagonia, in 50° S. latitude)

Oryzomys (*Thallomyscus*)

This apparently represents a purely local offshoot of *Oryzomys* confined to the Andean area of Peru, Ecuador, and Colombia, which possesses the general facies of *Oligoryzomys* but is to be distinguished by characters pointed out by Thomas. *Thallomyscus* and *Oligoryzomys* seem to occur together and occupy the same habitats.

dryas dryas Thomas	Pallatanga, Ecuador
dryas humilior Thomas	Plains of Bogotá, Colombia
aurillus Thomas	Torontoy, near Cuzco, Peru

Oryzomys (*Melanomys*)

Considering the relatively large number of forms of *Melanomys*, and the restriction of most of them to the relatively small region (No. 2) north and west of the Andes, it seems not improbable that further reduction in their ranks is required.

Region 1 (Central America)

caliginosus chrysomelas Allen	Suerre, Central Costa Rica, 3000–5000 ft.

Region 2 (north and west of the Andes, and Panama)

caliginosus caliginosus (Tomes)	Western Ecuador
caliginosus idoneus Goldman	Cerro Azul, near headwaters of Chagres R., Panama, 2500 ft.
caliginosus oroensis (Allen)	Rio de Oro, Manavi, Ecuador, 1500 ft.
phæopus phæopus Thomas	Pallatanga, Ecuador
phæopus obscurior Thomas	Concordia, Medellin, Colombia
phæopus vallicola (Allen)	Rio Frio, Cauca Valley, Colombia, 3500 ft.
phæopus tolimensis (Allen)	R. Toché, Tolima, Colombia, 6800 ft.
columbianus (Allen)	Manzanares, Santa Marta district, Colombia
affinis affinis Allen	San José, Cauca, Colombia, 200 ft.
affinis monticola (Allen)	Galera, west slope of western Andes, Colombia, 5700 ft.
lomitensis (Allen)	Las Lomitas, western Andes, Colombia, 5000 ft.

Region 5 (central Venezuela to Trinidad)

buenavistæ (Allen)	Buenavista, 50 miles southeast of Bogotá, Colombia
robustulus Thomas	Gualaquiza, eastern Ecuador, 2500 ft.

LIST OF REFERENCES

ALLEN, J. A.

1891*a*. Bull. Amer. Mus. Nat. Hist., III, pp. 203–218.

1891*b*. Bull. Amer. Mus. Nat. Hist., III, pp. 263–310.

1891*c*. Proc. U. S. Nat. Mus., p. 193.

1892. Bull. Amer. Mus. Nat. Hist., IV, pp. 47–50.

1893. Bull. Amer. Mus. Nat. Hist., V, pp. 237–240.

1895. Bull. Amer. Mus. Nat. Hist., VII, pp. 327–340.

1897*a*. Bull. Amer. Mus. Nat. Hist., IX, pp. 31–44.

1897*b*. Bull. Amer. Mus. Nat. Hist., IX, pp. 47–58.

1897*c*. Bull. Amer. Mus. Nat. Hist., IX, pp. 115–119.

1897*d*. Bull. Amer. Mus. Nat. Hist., IX, pp. 197–208.

1899. Bull. Amer. Mus. Nat. Hist., XII, pp. 195–218.

1900. Bull. Amer. Mus. Nat. Hist., XIII, pp. 219–227.

1901. Bull. Amer. Mus. Nat. Hist., XIX, pp. 405–412.

1904*a*. Bull. Amer. Mus. Nat. Hist., XX, pp. 327–335.

1904*b*. Bull. Amer. Mus. Nat. Hist., XX, pp. 407–468.

1905. 'Report Princeton Patagonian Expedition," III, (1).

1908. Bull. Amer. Mus. Nat. Hist., XXIV, pp. 647–670.

1910. Bull. Amer. Mus. Nat. Hist., XXVIII, pp. 87–115.

1911. Bull. Amer. Mus. Nat. Hist., XXX, pp. 239–273.

1912. Bull. Amer. Mus. Nat. Hist., XXXI, pp. 71–95.

1913*a*. Bull. Amer. Mus. Nat. Hist., XXXII, pp. 469–484.

Allen, J. A.	1913*b*.	Bull. Amer. Mus. Nat. Hist., XXXII, pp. 533–555.
	1913*c*.	Bull. Amer. Mus. Nat. Hist., XXXII, pp. 597–604.
	1915.	Bull. Amer. Mus. Nat. Hist., XXXIV, pp. 625–634.
	1916*a*.	Bull. Amer. Mus. Nat. Hist., XXXV, pp. 83–87.
	1916*b*.	Bull. Amer. Mus. Nat. Hist., XXXV, pp. 523–530.
Allen, J. A., and Chapman, F. M.	1893.	Bull. Amer. Mus. Nat. Hist., V, pp. 203–234.
	1897.	Bull. Amer. Mus. Nat. Hist., IX, pp. 13–30.
Alston, E. R.	1876.	Proc. Zool. Soc. London, pp. 755–756.
	1880.	'Biologia Centrali-Americana,' Mammalia.
Anthony, H. E.	1924.	Amer. Mus. Novit., No. 139.
	1926.	Amer. Mus. Novit., No. 240.
Azara, F.	1801.	'Essais Quadr. Paraguay,' II.
	1802.	'Apuntamientos Quadr. Paraguay,' II.
Baird, S. F.	1859.	'Mammals of North America.'
Bangs, O.	1898.	Proc. Biol. Soc. Wash., XII, pp. 161–165.
	1899.	Proc. Biol. Soc. Wash., XIII, pp. 9–10.
	1900.	Proc. N. England Zool. Club, I, pp. 87–102.
	1902.	Bull. Mus. Comp. Zoöl., XXXIX, pp. 17–51.
Bennett, E. T.	1832.	Proc. Zool. Soc. London, p. 2.
	1835.	Proc. Zool. Soc. London, p. 191.
Bridges, T.	1843.	Proc. Zool. Soc. London, p. 129.
Burmeister, H.	1854.	'Syst. Uebersicht der Thiere Brasiliens.'
	1855.	Abh. Naturf. Ges. Halle, II (1), (1854).
Cassin, J.	1858.	'U. S. Explor. Exped.,' 2d Ed., VIII.
Coues, E.	1874.	Proc. Acad. Nat. Sci. Phila., XXVI, p. 183.
	1877.	'Mon. N. Amer. Rodent.' Report Hayden Geol. Survey.
	1890.	'Century Dictionary,' V.
Desmarest, A. G.	1819.	Nouv. Dict. d'Hist. Nat., 2d Ed., XXIX.
	1820.	'Mammalogie.'
Elliot, D. G.	1903.	Field Mus. Nat. Hist., Zool. Ser., III, pp. 141–149.
	1904.	Field Mus. Nat. Hist., Zool. Ser., III, pp. 263–270.

Figuera, J. H.	1894.	Anales Mus. Nac. Montevideo, II, pp. 187–217.
Goeldi, E. A.	1893.	'Os Mammiferos do Brasil.'
Goldman, E. A.	1912.	Smiths. Misc. Coll., LVI, No. 36.
	1913.	Smiths. Misc. Coll., LX, No. 22.
	1915.	Proc. Biol. Soc. Wash., XXVIII, pp. 127–130.
	1916*a*.	Proc. Biol. Soc. Wash., XXIX, p. 127.
	1916*b*.	Proc. Biol. Soc. Wash., XXIX, pp. 155–156.
	1918.	'North Amer. Fauna,' XLIII.
Harris, W. P.	1932.	Occasional Papers Mus. Zool., Univ. Michigan, No. 248.
Heller, E.	1904.	Calif. Acad. Sci., (3) III.
Hensel R.	1872.	Abh. k. Akad. Wiss. Berlin, p. 42.
Ihering, H. von	1893.	'Os Mammiferos do Rio Grande do Sul.' Annuario do Estado do Rio Grande do Sul, para o anno 1893, de Graciano A. de Azambuja.
	1894.	'Os Mammiferos de São Paulo, Catalogo.'
Leche, W.	1886.	Zool. Jahrb., I, pp. 687–700.
Lund, P. W.	1841.	Selskabs. k. danske, Vid. Skrifter, (4) VIII.
Lyon, M. W., and Osgood, W. H.	1909.	Bull. U. S. Nat. Mus., LXII.
Merriam, C. H.	1898.	Proc. Biol. Soc. Wash., XII, pp. 13–19.
	1901*a*.	Proc. Biol. Soc. Wash., XIV, pp. 99–104.
	1901*b*.	Proc. Wash. Acad. Sci., III, pp. 273–295.
Miller, G. S., Jr.	1924.	Bull. U. S. Nat. Mus., CXXVIII.
Murie, A.	1932.	Occasional Papers Mus. Zool., Univ. Michigan, No. 245.
Osgood, W. H.	1912.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 33–66.
	1913.	Field Mus. Nat. Hist., Zool. Ser., X. pp. 93–100.
	1914.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 143–185.
	1916.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 199–216.
Peale, T. R.	1848.	'U. S. Explor. Exped.,' VIII (suppressed edition).
Pelzeln, A. von	1883.	Verh. k. k. zool. bot. Ges. Wien, XXXIII, Anhang.
Philippi, R. A.	1900.	Anales Mus. Nac. Chile, No. 14.
Philippi, R. A., and Landbeck, L.	1858.	Arch. f. Naturg., I.

Pictet, F.-J., and Pictet, C. 1844. 'Notices sur les animaux nouveaux ou peu connus du Musée de Genève,' pp. 41–82. (Separately published by Soc. Phys. Hist. Nat. Genève.)

Rengger, J. R. 1830. 'Naturg. Saugethiere Paraguay.'

Robinson, W., and Lyon, M. W. 1902. Proc. U. S. Nat. Mus., XXIV.

Saussure, H. de 1860. Revue Mag. Zool., pp. 97–110.

Schinz, H. 1845. 'Syst. Verzeichn. Saug. oder Synopsis Mammalium,' II.

Stone, W. 1914. Proc. Acad. Nat. Sci. Phila., LXVI, pp. 9–19.

Thomas, O. 1881. Proc. Zool. Soc. London, p. 3.

1882. Proc. Zool. Soc. London, pp. 98–111.

1884. Proc. Zool. Soc. London, pp. 447–458.

1886. Ann. Mag. Nat. Hist, (5) XVIII, pp. 421–423.

1891. In Milne-Edwards, 'Mission Sci Cape Horn,' VI.

1893. Ann. Mag. Nat. Hist, (6) XI, pp. 402–405.

1894. Ann. Mag. Nat. Hist., (6) XIV, pp. 346–366.

1895*a*. Ann. Mag. Nat. Hist., (6), XVI, pp. 55–60.

1895*b*. Ann. Mag. Nat. Hist., (6) XVI, pp. 367–370.

1896. Proc. Zool. Soc. London, pp. 1012–1028.

1897*a*. Ann. Mag. Nat. Hist., (6) XIX, p. 355.

1897*b*. Ann. Mag. Nat. Hist., (6) XIX, pp. 454–501.

1897*c*. Ann. Mag. Nat. Hist., (6) XX, pp. 544–552.

1898*a*. Ann. Mag. Nat. Hist., (7) I, pp. 176–180.

1898*b*. Ann. Mag. Nat. Hist., (7) I, pp. 451–457.

1898*c*. Ann. Mag. Nat. Hist., (7) II, pp. 265–275.

1899*a*. Ann. Mag. Nat. Hist., (7) III, pp. 152–155.

1899*b*. Ann. Mag. Nat. Hist., (7) IV, pp. 278–288.

1899*c*. Ann. Mag. Nat. Hist., (7) IV, pp. 378–383.

1900*a*. Ann. Mag. Nat. Hist., (7) V, pp. 269–274.

THOMAS, O.
1900*b*. Ann. Mag. Nat. Hist., (7) V, pp. 354–357.
1901*a*. Ann. Mag. Nat. Hist., (7) VIII, pp. 139–154.
1901*b*. Ann. Mag. Nat. Hist., (7) VIII, pp. 246–255.
1901*c*. Ann. Mag. Nat. Hist., (7) VIII, pp. 526–536.
1902*a*. Ann. Mag. Nat. Hist., (7) IX, pp. 59–64.
1902*b*. Ann. Mag. Nat. Hist., (7) IX, pp. 125–143.
1902*c*. Ann. Mag. Nat. Hist., (7) X, pp. 246–250.
1903. Novit. Zool., X, pp. 39–42.
1904. Ann. Mag. Nat. Hist., (7) XIII, pp. 142–144.
1906. Ann. Mag. Nat. Hist., (7) XVIII, pp. 442–448.
1910. Ann. Mag. Nat. Hist., (8) VI, pp. 184–189.
1913*a*. Ann. Mag. Nat. Hist., (8) XI, pp. 404–409.
1913*b*. Ann. Mag. Nat. Hist., (8) XII, pp. 567–574.
1914. Ann. Mag. Nat. Hist., (8) XIV, pp. 240–244.
1916. Ann. Mag. Nat. Hist., (8) XVII, pp. 182–187.
1917*a*. Smiths. Misc. Coll., LXVIII, No. 4.
1917*b*. Ann. Mag. Nat. Hist., (8) XX, pp. 95–100.
1920. Proc. U. S. Nat. Mus., LVIII, p. 229.
1921*a*. Ann. Mag. Nat. Hist., (9) VIII, pp. 177–179.
1921*b*. Ann.Mag. Nat. Hist., (9) VIII, pp. 448–450.
1921*c*. Ann. Mag. Nat. Hist., (9) VIII, pp. 354–357.
1921*d*. Proc. U. S. Nat. Mus., LVIII, pp. 217–249.
1924. Ann. Mag. Nat. Hist., (9) XIV, pp. 143–144.
1925. Ann. Mag. Nat. Hist., (9) XV, pp. 575–582.
1926. Ann. Mag. Nat. Hist., (9) XVII, pp. 610–616.

THOMAS, O. 1927*a*. Ann. Mag. Nat. Hist., (9) XIX, pp. 361–373

1927*b* Ann. Mag. Nat. Hist., (9) XIX, pp. 545–554.

1927*c* Ann. Mag. Nat. Hist., (9) XX, pp. 594–608.

1929. Ann. Mag. Nat. Hist., (10) IV, pp. 35–46.

TOMES, R. F. 1860*a*. Proc. Zool. Soc. London, pp. 211–221.

1860*b*. Proc. Zool Soc. London, pp. 260–268.

TROUESSART, E.-L. 1898. 'Cat. Mamm. viv. foss.'

1905. 'Cat. Mamm. viv. foss., Supplement.'

TSCHUDI, J. J. VON. 1845. 'Fauna Peruana,' (1844).

WAGNER, A. 1842. Arch. f. Naturg., I, pp. 356–362.

1843. Schreber's 'Saugethiere,' Supplement III.

1845. Arch. f. Naturg., I, pp. 145–149.

1850. Abh. Math-Phys. Classe, Akad. Wiss., V, pp. 306–317.

WATERHOUSE, G. R. 1837. Proc. Zool. Soc. London.

1839. 'Zoology Voyage "Beagle."'

WINGE, H. 1887. E. Museo Lundu, I, pt. 3.

WOLFFSOHN, J. A: 1910. Bol. Mus. Nac. Chile, II.

AMERICAN MUSEUM NOVITATES

Number 582 — Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City — Nov. 14, 1932

59.9, 32 A (801)

THE TAXONOMIC HISTORY OF THE SOUTH AND CENTRAL AMERICAN AKODONT RODENT GENERA: *THALPOMYS, DELTAMYS, THAPTOMYS, HYPSIMYS, BOLOMYS, CHROEOMYS, ABROTHRIX, SCOTINOMYS, AKODON* (*CHALCOMYS* AND *AKODON*), *MICROXUS, PODOXYMYS, LENOXUS, OXYMYCTERUS, NOTIOMYS*, AND *BLARINOMYS*

BY G. H. H. TATE

In this paper, the sixth of my series, I have continued the treatment given in earlier papers. Since neither the several new akodont genera proposed by Thomas nor his "groups" of the subgenus *Akodon* (*sensu stricto*) appear to be sharply defined, geographic arrangement of the species has been particularly difficult and may prove unsatisfactory. Though wishing to preserve, as much as possible, the arrangement of genera made by Thomas (1916), I have felt that certain changes were desirable: *Zygodontomys* has been treated in my fifth paper, and the akodont genera are rearranged so as to include *Scotinomys* and the new genera *Deltamys* and *Hypsimys* and to place *Akodon* (*Akodon*) next to *Microxus*.

HISTORICAL STATEMENT[1]

THALPOMYS Thomas

1841. Lund described (p. 280) *Mus lasiotis* (n. sp.). The original description of "the smallest of all kinds" of Lagoa Santa rodents reads very like that of a *Hesperomys*.

1854. Burmeister added information about (p. 177) *lasiotis*, placing it in *Hesperomys* (*Calomys*).

1887. Winge gave a detailed description (p. 29) of "*Habrothrix*" *lasiotis*.

1898. Trouessart listed (p. 536) *lasiotis* in *Akodon*.

1916c. Thomas erected (p. 339) *Thalpomys*, n. g., with type *Mus lasiotis* Lund.

---

[1]A copy of the newly published 'A Manual of Neotropical Sigmodont Rodents,' by Nils Gyldenstolpe (Kungl. Svenska Vetenskapsakad. Handlingar, (3) XI, No. 3, pp. I–164 and plates, 1932) has just been received. This work should be consulted for each cricetid genus. It reached my hands too late to receive treatment under the generic headings.

Deltamys Thomas

1917*b*. Thomas erected (p. 98) *Deltamys*, n. g., related to *Akodon*, with type *Deltamys kempi*, n. sp. (which he compared with *Akodon arenicola*).

Thaptomys Thomas

1827. Lichtenstein described (Pl. xxxv) *Mus nigrita* (n. sp.).

1843. Wagner wrote of (p. 523) *nigrita* under *Hesperomys* (*Habrothrix*).

1854. Burmeister gave further information (p. 181) concerning *nigrita*.

1872. Hensel described (p. 44) *Hesperomys subterraneus*, n. sp., made type of *Thaptomys* by Thomas, in 1916.

1886. Leche described (p. 697) "*Hesperomys subterraneus* Hens. var. *henseli* var. nov."

1893. Von Ihering, in 'Os Mammiferos do Rio Grande do Sul.,' doubted (p. 17) the validity of Leche's separation of *henseli* from *subterraneus*.

1898. Trouessart listed (p. 537) *nigrita*, *subterraneus*, and *subterraneus henseli* in *Akodon*.

1902*a*. Thomas discussed (p. 62) under *Akodon subterraneus* the possible identity of that name with *nigrita*, *fuliginosus* (an *Akodon*), and *orycter*. (This last was a fossil form described by Winge (1887), who thought it near *Akodon cursor*.)

1916*c*. Thomas erected (p. 339) *Thaptomys*, n..g., with type *Hesperomys subterraneus* Hensel, and suggested that *nigrita* also belonged in it.

Hypsimys Thomas

1918. Thomas erected (p. 190) *Hypsimys*, n. g., which he compared with *Akodon*, *Deltamys*, and *Microxus*. The type species was *Hypsimys budini*, n. sp.

1920*a*. Thomas declared that *Akodon simulator* was intermediate in hypsodontism between *Hypsimys* and *Akodon arenicola*.

1921*c*. Thomas described (p. 613) *Hypsimys deceptor*, n. sp.

Bolomys Thomas

1858. Philippi and Landbeck described (p. 77) *Mus andinus*, n. sp., supposed representatives of which were compared by Thomas (1920) with *jucundus*.

1897*b*. Thomas described (p. 217) *Akodon albiventer*, n. sp.

1898*b*. Thomas described (p. 281) *Akodon berlepschii*, n. sp., pointing out the similarity of the skull to that of *Akodon mollis*.

1898. Trouessart listed (p. 535) the above species under *Akodon*.

1900*b*. Thomas described (p. 468) *Akodon amœnus*, n. sp., "probably most nearly allied to . . . *A. punctulatus*."

1900. Philippi further described (p. 22) and figured (Pl. VI) *andinus*.

1902*c*. Thomas remarked (p. 226) upon the near relationship of *albiventer* and *berlepschii* to one another.

1913*a*. Thomas described (p. 140) *Akodon jucundus*, n. sp., comparing it with *albiventer*, *andinus*, and *puer*.

1916*c*. Thomas erected (p. 339) *Bolomys*, n. g., with type *Akodon amœnus* Thomas, listing also in it *albiventer* and *berlepschii*.

1918. Thomas described (p. 188) *Akodon lactens*, n. sp.

1919*d*. Thomas described (p. 496) *Akodon orbus*, allied to *lactens*.

1920*b*. Thomas described (p. 418) *Akodon gossei*, n. sp., based upon material which he had earlier considered to be *andinus* (Philippii). He contrasted it with *jucundus* and *andinus*.

1926*a*. Thomas described (p. 312) *Bolomys negrito*, n. sp., comparing it with *albiventer* and "*B.* " *lactens*. *Lactens* when described (1918) was not placed in *Bolomys*.

1926*c*. Thomas remarked (p. 323) that m^1 of *albiventer* is notched.

1926*d*. Thomas wrote (p. 605): ". . . the curious blackish species recently described as *B. negrito* . . . may be merely a dark or semi-melanoid race of *B. lactens*."

CHRŒOMYS Thomas

1847. Gay described (p. 108) *Orymicterus* (*sic*) *scalops* (n. sp.) (a *Notiomys*,—see remark under that genus).

1884. Thomas wrote of "*scalops*" (p. 455): ". . . his [Gay's] description . . . is too exact to admit any doubt that the present [specimen] is really his species . . . *H. scalops*, owing to its long claws, was placed in the subgenus *Oxymycterus* by its describer, but . . . the skull proves it to belong to *Habrothrix*, of which it is by far the most lightly marked member." (Renamed *jelskii* in 1894.)

1894. Thomas (pp. 360–361) applied the names *Acodon jelskii*, n. sp., and *Acodon jelskii pyrrhotis*, n. subsp., to the mice which he had identified as *scalops* (Gay in 1884).

1897*d*. Thomas described (p. 459) *Akodon pulcherrimus*, n. sp.

1898. Trouessart listed (p. 535) the described species of *Chrœomys* under *Akodon*.

1901*a*. Thomas, discussing the distribution of "*Akodon pulcherrimus* and its subspecies" (p. 184), described, besides typical *pulcherrimus*, *Akodon pulcherrimus cayllomæ*, n. subsp., *Akodon pulcherrimus inambarii*, n. subsp., and *Akodon pulcherrimus cruceri*, n. subsp.

1902*b*. Thomas described (p. 138) *Akodon bacchante*, n. sp.

1905. J. A. Allen suggested (p. 71) that *pulcherrimus* might represent a distinct subdivision of *Akodon*.

1913*a*. Thomas described (p. 141) *Akodon bacchante sodalis*, n. subsp.

1916*c*. Thomas erected (p. 340) *Chrœomys*, n. g., with type *Akodon pulcherrimus*, listing also in the genus *bacchante*, *jelskii*, "and probably *scalops* Gay" (the last a *Notiomys*).

1917*a*. Thomas described (p. 2) *Chrœomys inornatus*, n. sp.

1921*d*. Thomas added a great amount of additional description (p. 238) of *inornatus*.

1926*b*. Thomas suggested (pp. 317–318) that *jelskii pyrrhotis* might represent immature specimens of *jelskii jelskii*.

ABROTHRIX Waterhouse

1837. Waterhouse erected (p. 21) *Abrothrix*, n. subg. of *Mus*, with type *Mus longipilis* (n. sp.). He also referred to it (pp. 16–18) *Mus obscurus* (n. sp.) and *Mus olivaceus* (n. sp.) (both *Akodon*), *Mus brachiotis* (n. sp.) (an *Abrothrix*), *Mus xanthorhinus* (n. sp.), *Mus canescens* (n. sp.), and *Mus arenicola* (n. sp.) (the last three *Akodon*).

1839. Waterhouse further described (p. 49) *brachyotis* (*sic*) and (p. 55) *longipilis*.

1843. Gray raised (p. 114) *Abrothrix* to generic rank.

1843. Bridges wrote concerning the habits of *Mus longipilis* (p. 129).

1847. Gay wrote (pp. 113–116) concerning *longipilis* and *brachyotis* (*sic*).

1872. Philippi described (p. 446) *Mus brevicaudatus* (n. sp.), considering it near *brachiotis* (an *Abrothrix*).

1895. Thomas described (p. 370) *Acodon hirtus*, n. sp., comparing it with *longipilis*.

1898. Trouessart listed (p. 535) the speciesof *Abrothrix* under *Akodon*.

1900. Philippi described a large number of species of "*Mus*," three of which (*dumetorum*, *brachitarsus*, and *fusco-ater*) Wolffsohn (1910) synonymized with *longipilis*.

1903*c*. Thomas described (p. 241) *Akodon suffusus*, n. sp., which he compared with *hirtus* and *longipilis*. *Suffusus* was made a subspecies of *hirtus* in 1927.

1908. Thomas described (p. 497) *Akodon francei*, n. sp., allied to *longipilis*, *hirtus*, and *suffusus*.

1910. Wolffsohn synonymized three of Philippi's (1900) names with *longipilis*.

1916*c*. Thomas reinstated, in restricted form distinct from *Akodon* (p. 340), *Abrothrix* Waterhouse, which, since 1894, had been considered a synonym of the former. He listed in it *longipilis* (the type), *hirtus*, *suffusus*, and *francei*.

1919*b*. Thomas described (p. 202) *Abrothrix suffusus modestior*, n. subsp., and *Abrothrix suffusus mœrens*, n. subsp.
He remarked that *brachiotis* Waterhouse should be listed in *Abrothrix*.

1925*b*. Thomas described (p. 582) *Abrothrix illutea*, n. sp.

1927*b*. Thomas listed (p. 551) the British Museum lectotype of *brachiotis*, 55.12.24.166, Islet in Midship Bay, Chonos Archipelago, Chile; and lectoparatype, 55.12.24.166, Islet off east coast of Chiloe. "This latter specimen is not an *Abrothrix*, but is referable to a species of *Akodon*."

1927*d*. Thomas stated (p. 201) "*A. hirtus* and *A. suffusus* . . . pass into each other and should be united specifically under the former name."

1929. Thomas gave (p. 40) a brief diagnosis of the subspecies of *hirta* and described *Abrothrix hirta nubila*, n. subsp.
He remarked (p. 41) upon the high altitude habitat of *illutea*, correcting the original statement of altitude (400 m.) to 3000–4000 meters.

Scotinomys Thomas

1876. Alston described (p. 755) *Hesperomys teguina*, n. sp.[1]

1880. Alston remarked further upon *teguina* (p. 144). He placed it (p. 142) provisionally in "*Hesperomys* (*Vesperomys*)."

1898. Trouessart listed (p. 537) *teguina* under *Akodon*.

1902. Bangs described (p. 40) *Akodon teguina apricus*, n. subsp., and (p. 41) *Akodon xerampelinus*, n. sp.

1904*a*. J. A. Allen described (p. 46) *Akodon irazu*, n. sp.

[1]Gray listed the name *teguina* (a *nomen nudum*) as early as 1843 (Proc. Zool. Soc London, p. 79).

1913*b*. Thomas erected (p. 408) *Scotinomys*, n. g., with type *Hesperomys teguina* Alston, and included *teguina apricus, xerampelinus*, and *irazu*. He compared the new genus with *Akodon* and *Zygodontomys*.

Akodon (Chalcomys) Thomas

1893. Allen and Chapman remarked upon (p. 217) "*Abrothrix caliginosus*" from Trinidad. (Redescribed in 1897 as *Akodon urichi*.)

1897. Allen and Chapman described (p. 19) *Akodon urichi*, n. sp., based upon the material referred by them in 1893 to *caliginosus*. They also described (p. 20) *Akodon frustrator*, n. sp., based upon two juveniles which I believe are the young of *Zygodontomys brevicauda*.

1898. Trouessart listed (p. 535) the species of *Chalcomys* in *Akodon*.

1899. J. A. Allen described (p. 203) *Akodon venezuelensis*, n. sp., superficially like *Melanomys*.

1904*b*. J. A. Allen described (p. 329) *Akodon meridensis*, n. sp. In 1913 (p. 408) Thomas suggested that it might be a *Zygodontomys*. I have examined the type, however, and it seems to be *Akodon*.

1913*b*. Thomas described (p. 406) *Akodon ærosus*, n. sp. (Specimens of this animal had previously been alluded to by J. A. Allen and Thomas in various papers under Tomes's name *caliginosus*, which is a *Melanomys* of rather similar appearance.)

1913*a*. J. A. Allen described (p. 480) *Akodon tolimæ*, n. sp.

1913*b*. J. A. Allen described (p. 600) *Akodon chapmani*, n. sp.

1915. Osgood described (p. 192) *Akodon ærosus baliolus*, n. subsp.

1916. Osgood described (p. 208) *Akodon dayi*, n. sp. "The only available species of this region which shows even slight similarity is *A. cursor* . . . ."

1916*c*. Thomas erected (p. 338) *Chalcomys*, n. subg. of *Akodon* (restricted in same paper), with type *Akodon ærosus*. He placed *urichi, venezuelensis*, and *meridensis* in *Chalcomys*.

Akodon (Akodon) Meyen

1802. Azara described (p. 94) his AGRESTE, given the scientific name *Mus? (sic) azaræ* by Fischer in 1829. I have suggested in Amer. Mus. Novit., No. 557, that this mouse was an *Akodon*.

1827. Lichtenstein described (Pl. xxxv) *Mus nigrita* (n. sp.) (a *Thaptomys*).

1829. Fischer applied (p. 324) the name *Mus? (sic) azaræ* to Azara's AGRESTE.

1832. Meyen erected (p. 600) the genus *Akodon* to contain *Akodon "boliviense,"* n. sp.

1837. Waterhouse erected (p. 21) *Abrothrix*, n. subg. of *Mus* (until 1916 treated as a synonym of *Akodon*) with type *Mus longipilis* (n. sp.). He also referred to it (pp. 16–18) *Mus obscurus* (n. sp.), *Mus olivaceus* (n. sp.), *Mus xanthorhinus* (n. sp.), *Mus canescens* (n. sp.), and *Mus arenicola* (n. sp.). (All five names belong in *Akodon*.)

1839. Waterhouse further described (p. 48) *arenicola;* (p. 51) *olivaceus* which he renamed *renggeri*, a synonym; (p. 52) *obscurus;* (p. 53) *xanthorhinus;* and (p. 54) *canescens*. (He corrected a slight error in the tail measurements of the last, given in 1837.)

1841. Lund described briefly (p. 280) *Mus lasiotis* (made type of *Thalpomys* by Thomas, 1916).

1842. Gervais described (p. 51) *Mus rupestris* from a skeleton picked up in Cobija, Bolivia.

1843. Wagner retained (p. 466) *Akodon* with its then single species *boliviense* as a full genus. *Hesperomys* (*Habrothrix*) (p. 516) was made to include the remaining species as follows: *longipilis* (an *Abrothrix*), *olivaceus* (=*renggeri*), *obscurus, arenicola, xanthorhinus, canescens,* and *nigrita* (a *Thaptomys*).

1844. Waterhouse described (p. 154) *Hesperomys megalonyx*, n. sp. (a *Notiomys*).

1844. Tschudi commented upon (p. 177) *boliviense*, and emended the spelling of *Akodon* Meyen to *Acodon*.

1845. Wagner described (p. 148) *fuliginosus* (n. sp.) and *caniventris* (n. sp.).

1847. Gay gave notes (pp. 113–116) on *olivaceus, "rupestris,"* and *"xanthorhinus."*

He tried to show that a certain Chilean mouse was identical with the *rupestris* Gervais of Cobija, Bolivia. Both were illustrated in the 'Atlas,' plates VI and VII.

1850. Wagner added (pp. 314–315) to his descriptions of *fuliginosus* and *caniventris*. He stated that he was ignorant of the place of origin of *caniventris* in Brazil.

1855. Burmeister (1854) commented upon (pp. 11–12) *Akodon boliviense* Meyen.

1858. Philippi described (p. 77) *Mus andinus*, n. sp. (apparently a *Bolomys*, see Thomas (1920)), and (p. 79) *Mus pusillus* (probably *Akodon olivaceus*), with which Allen compared *lutescens* in 1901.

1872. Philippi described (p. 446) *Mus brevicaudatus* (n. sp.) (=?*Akodon olivaceus*), considering it nearest to *brachiotis* (an *Abrothrix*).

1872. Hensel referred (p. 39) a mouse from Rio Grande do Sul, Brazil, doubtfully to *arenicola* of Uruguay.

1879. Burmeister listed (pp. 216–217) *arenicola* and *obscurus* in *Hesperomys* (*Habrothrix*). He placed the AGRESTE of Azara (=*Mus azaræ* Fischer) in the synonymy of *arenicola*. *Canescens* was put at the end of the subgenus *Calomys*.

1883. Pelzeln commented upon *fuliginosus* (p. 70).

1884. Thomas, after defining *Habrothrix*, subgenus of *Hesperomys*, included (p. 450) all *Akodon*-like mice except *Oxymycterus* in *Habrothrix*, mentioning specifically *longipilis*, *olivaceus*, *xanthorhinus*, . . . "about 20 in number."

His "*scalops*" included *Chrœomys jelskii* and *C. j. pyrrhotis*. His "*olivaceus*" from Peru was probably an *Akodon* of a different species and his "*xanthorhinus*" was *Akodon puer* (see 1926).

1886. Leche, writing of *arenicola* from Rio Grande do Sul, stated (p. 698) that Thomas had compared his material with Waterhouse's original animal and had found them identical. He pointed out discrepancies in Waterhouse's drawings of the skull ('Voyage of the "Beagle"') and gave much additional data upon the species.

1888. Winge described (p. 25) *Habrothrix cursor*, n. sp. (probably an *Akodon*).

1891. Thomas in Milne-Edwards published plates (V and VI) showing *olivaceus*, "*xanthorhinus*," and *longipilis*. The skin of "xanthorhinus" was described by Thomas as *Oxymycterus lanosus* (a *Microxus*) in 1897.

1894. Thomas decided (p. 360) that *Habrothrix*, which he had hitherto employed for all akodonts, must be placed in the synonymy of *Acodon* (*sic*) Meyen.

He described (pp. 360–361) *Acodon jelskii* and *Acodon jelskii pyrrhotis*, n. subsp. (both *Chrœomys*).

He described *Acodon punctulatus*, n. sp. (remarking upon certain *Oryzomys*-like features of the skull), *Acodon*

macronyx, n. sp., (a *Notiomys*), and *Acodon mollis*, n. sp., "northern representative of *A. olivaceus*."

1895. Thomas described (p. 369) *Acodon bogotensis*, n. sp. (a *Microxus*), comparing it with "*Melanomys caliginosus*" (probably *Akodon ærosus*) and *Scotinomys teguina*.

He described (p. 370) *Acodon hirtus*, n. sp. (an *Abrothrix*, as restricted by Thomas, 1916).

1896*a*. Thomas, in 'Genera of Rodents,' listed "*Acodon* Meyen," with *Abrothrix* Waterhouse as a synonym.

1897*a*. Thomas described (p. 496) *Akodon fuscinus*, n. sp. (a *Zygodontomys*), comparing it with *lasiurus* (Lund), which I have suggested in an earlier paper may also have been a *Zygodontomys*, and with *olivaceus* (Waterhouse).

1897*b*. Thomas described (p. 216) *Akodon spegazzinii*, n. sp., compared with *olivaceus* but stated to be colored more like a fulvous *Oryzomys*.

He also described (p. 217) *Akodon albiventer*, n. sp. (a *Bolomys*), comparing it with *spegazzinii*.

1897*d*. Thomas described (p. 549) *Akodon pulcherrimus* (n. sp.) (a *Chrœomys*).

1898*a*. Thomas doubted (p. 211) the distinctness of *canescens* and *arenicola*.

1898*b*. Thomas described (p. 281) *Akodon berleppschii*, n. sp. (a *Bolomys*).

1898*c*. Thomas described (p. 271) *Akodon lenguarum*, n. sp., comparing it with *obscurus*.

1898. Trouessart listed (p. 535) *Akodon* full genus with *Abrothrix* or *Habrothrix* as a synonym. The genus was divided into two subgenera, *Drymomys* and *Akodon*.

Akodon included all the generic groups distinguished by Thomas in 1916, as well as *Scotinomys*.

Furthermore, the following species, belonging to modern genera as indicated, were listed in *Akodon*.—*Oryzomys: magellanicus, caliginosus. Zygodontomys: fuscinus, lasiurus. Euneomys: micropus. Delomys: dorsalis, dorsalis obscura. Notiomys: megalonyx, macronyx, valdivianus, niger*.

Philippi's names *andinus, melanonotus, porcinus, pusillus* (all 1858), and *brevicaudatus* (1872) were listed in *Akodon*.

1898. Matschie wrote (pp. 4–5) concerning *valdivianus* and *michaelseni* (both *Notiomys*) under "*Hesperomys* (*Acodon*)."

His notes (pp. 6–7) upon *olivaceus* and *xanthorhinus* were also placed under *Hesperomys* (*Acodon*).

1899. J. A. Allen described (p. 203) *Akodon venezuelensis*, n. sp. (a *Chalcomys*) and *Akodon columbianus*, n. sp., removed in 1904 (Bull. Amer. Mus. Nat. Hist., XX, p. 437), to *Oryzomys* (*Melanomys*).

1900*b*. Thomas described (p. 468) *Akodon amœnus*, n. sp. (a *Bolomys*).

1900. Philippi described a large number of Chilean mice under the generic name *Mus*, seven of which—*lepturus, trichotis, vinealis, senilis, germaini, nasica*, and *ruficaudus*—have been synonymized by Wolffsohn (1910) with *Akodon olivaceus*. He further described *andinus* and *pusillus*.
For Philippi's names which are synonymous with *longipilis*, see *Abrothrix*.

1901*a*. Thomas, discussing (p. 184) "*Akodon pulcherrimus* and its subspecies" (*Chrœomys*), described three new subspecies: *pulcherrimus caylloma*, *pulcherrimus inambarii*, and *pulcherrimus cruceri*.

1901. J. A. Allen described (p 46) *Akodon lutescens*, n. sp. He compared it with "*A. pusillus* (Philippi)," one of the many dubious names proposed by Philippi. Philippi's description and figure of *pusillus* probably refer to a specimen of *Akodon olivaceus*.

1901. J. A. Allen described (p. 410) *Akodon tucumanensis*, n. sp. of the *olivaceus* group.

1902. Bangs described (p. 40) *Akodon teguina apricus*, n. subsp., and (p. 41) *Akodon xerampelinus*, n. sp. (both *Scotinomys*).

1902*a*. Thomas discussed (p. 60) *Akodon cursor* (Winge) and described (p. 61) *Akodon serrensis*, n. sp., which he compared with *arenicola*. He also discussed *Akodon subterraneus* (see under *Thaptomys*).

1902*b*. Thomas described (p. 134) *Akodon varius*, n. sp., which he compared with but distinguished sharply from *hirtus* (an *Abrothrix*); (p. 135) *Akodon pacificus*, n. sp., which he likened to *olivaceus* and *mollis*, mentioning the difficulty of working out the *olivaceus* species; (p. 136) *Akodon puer*, n. sp., a member of the olive-colored group allied to *xanthorhinus*; *Akodon fumeus*, n. sp., which he compared with *mollis*; and *Akodon bacchante*, n. sp. (a *Chrœomys*).

1903*c*. Thomas erected (p. 242) *Chelemys*, n. subg. of *Akodon* and described *Akodon* (*Chelemys*) *vestitus*, n. sp. (placed by Osgood in *Notiomys* in 1925).

1904*a*. J. A. Allen described (p. 46) *Akodon irazu*, n. sp. (a *Scotinomys*).

1904*b*. J. A. Allen described (p. 329) *Akodon meridensis*, n. sp. (by Thomas, 1916, placed in subgenus *Chalcomys*).

1904. Palmer recited (p. 87) modifications of spelling in *Akodon* employed by various authors.

1905. J. A. Allen proposed tentatively (pp. 70–71) several divisions of the genus *Akodon*. He redescribed *xanthorhinus* and *canescens* and included in *Akodon*, *suffusus*, *A.* (*Chelemys*) *vestitus* and *A.* (*Chelemys*) *michaelseni*.

1905. Ribeiro described (p. 188) *Hesperomys* (*Akodon*) *serrensis leucogula* (n. subsp.).

1905. Trouessart altered (pp. 432–435) his subgeneric arrangement of 1898 (listing *Akodon* with three subgenera, *Akodon*, *Drymomys*, and *Chelemys*). Apart from the inclusion of new species, and the separation of *Chelemys*, no marked changes were made in the previous list of species.

A list of Philippi's (1900) names was given (p. 435) with the suggestion that they might belong in *Akodon*.

1908. Thomas described (p . 497) *Akodon francei*, n. sp. (an *Abrothrix*).

1910. Wolffsohn synonymized a number of Philippi's (1900) names under *Akodon olivaceus*.

1913*a*. Thomas described (pp. 140–141) *Akodon jucundus*, n. sp. (a *Bolomys*), comparing it with *andinus* (Philippi), *albiventer*, *spegazzinii*, and *puer*; he also described *Akodon bacchante sodalis*, n. subsp. (a *Chrœomys*).

1913*b*. Thomas described (p. 404) *Akodon mollis altorum*, n. subsp.; and (p. 405) *Akodon arviculoides montensis*, n. subsp., comparing it with *cursor*. (It seems probable that *arviculoides* Wagner was a *Zygodontomys* rather than an *Akodon* and I have so placed it in Amer. Mus. Novit., No. 581. It is unlikely, however, that Thomas had before him anything other than a true *Akodon* when he described *montensis*, and I have therefore included *Akodon montensis* in the list on page 25).

He described (p. 406) *Akodon ærosus*, n. sp. (in 1916 made type of subgenus *Chalcomys*).

1913*a*. J. A. Allen described (p. 480) *Akodon tolimæ*, n. sp. (a *Chalcomys*).

1913*b*. J. A. Allen described (p. 600) *Akodon chapmani*, n. sp. (a *Chalcomys*).

1913. Osgood described (pp. 98–100) *Akodon mollis orophila*, n. subsp.,

and *Akodon mollis orientalis*, n. subsp. Thomas (see *Microxus*, 1921 and 1926) was inclined to place these forms in *Microxus*, but returned them (*Microxus*, 1927) to *Akodon*.

1914. Osgood constructed (p. 163) a short key to the four subspecies of *mollis*.

1915. Osgood described (p. 192) *Akodon ærosus baliolus*, n. subsp. (a *Chalcomys*).

1916*a*. Thomas corrected (p. 187) his determination of *xanthorhinus*, which in Milne-Edwards, 1890, he had referred to "*olivaceus*." His "*xanthorhinus*" of the same paper was renamed by him *lanosus* in 1897 (see under *Microxus*).

1916*b*. Thomas described (p. 334) *Akodon dolores*, n. sp., allied to *obscurus*, *lenguarum*, and *varius;* and (p. 335) *Akodon simulator*, n. sp., allied to *dolores*, but colored as *Abrothrix*.

1916*c*. Thomas divided (pp. 336–340) the old genus *Akodon* into six distinct generic groups: *Akodon* (restricted); *Thalpomys*, containing only *lasiotis* (Lund); *Thaptomys*, containing *subterraneus* and *nigrita* (?); *Bolomys*, containing *amœnus*, *albiventer*, and *berlepschii; Chrœomys*, containing *pulcherrimus*, *bacchante*, *jelskii*, "and probably *scalops*" (a *Notiomys*); and *Abrothrix*, with the species *longipilis*, *hirtus*, *suffusus*, and *francei*.

Zygodontomys was removed from the oryzomine assemblage and added to the above akodont genera. *Scotinomys* was not mentioned.

Furthermore, the restricted *Akodon* was divided into two subgenera, *Akodon* and *Chalcomys*, the latter to contain the *Melanomys*-like forms *ærosus*, *urichi*, *venezuelensis*, *meridensis*, etc.

Thomas suggested (p. 339) that *Akodon*, subgenus, might be even further divided.

1916. Osgood described (p. 208) *Akodon dayi*, n. sp. (a *Chalcomys*?).

1917*a*. Thomas described (p. 2) *Akodon surdus*, n. sp., "allied to *Akodon mollis*."

1917*b*. Thomas described (p. 97) *Akodon arenicola hunteri*, n. subsp.

1918. Thomas described (p. 188) *Akodon lactens*, n. sp. (a *Bolomys*), allied in skull characters to *obscurus*, and *Akodon puer cænosus*, n. subsp.

1919*a*. Thomas described (p. 116) *Akodon glaucinus* n. sp., very close to *varius* and *simulator*.

1919*b*. Thomas described (p. 204) *Akodon beatus*, n. sp., allied to "*olivaceus-arenicola* group."

He stated (p. 205) that the "primary type" of *canescens* was British Museum No. 55.12.24.157, and that of *xanthorhinus* 55.12.24.156. Remarking that two distinct groups of *Akodon*, which he briefly characterized and styled A and B, exist in "the area concerned" (the Patagonian region?) he added that since both *canescens* and *xanthorhinus* belonged in B, a new name was needed for A. He proposed *iniscatus*, new name, and referred certain of Darwin's specimens to it.

He described *Akodon iniscatus collinus*, n. subsp. He suggested (p. 207) that *canescens* might prove to be a "grey seasonal phase of the yellowish *xanthorhinus*."

1919*c*. Thomas described (p. 213) *Akodon neocenus*, n. sp., allied to *varius* (but see Ann. Mag. Nat. Hist., 1927, XX, p. 205), and (p. 214) *Akodon benefactus*, n. sp., related to *obscurus* and *lenguarum*.

1919*d*. Thomas described (p. 496) *Akodon alterus*, n. sp., allied to *spegazzinii*, remarking upon the color of the latter, and *Akodon orbus*, "a proodont *Akodon* allied to *lactens*" (a *Bolomys* ?).

1919*e*. Thomas described (p. 155) *Akodon tartareus*, n. sp., allied to *varius*.

1920*a*. Thomas pointed out (p. 192) that *simulator* is intermediate as regards hypsodontism between *arenicola* and *Hypsimys* and that its color is unusually variable.

He recognized (p. 192) *cænosus*, formerly a subspecies of *puer*, as a full species.

1920*b*. Thomas described (p. 418) *Akodon gossei*, n. sp. (a *Bolomys* ?), based upon material which he had previously considered to be *andinus* (Philippi). He contrasted it with *Bolomys jucundus*.

1921*a*. Thomas described (p. 178) *Akodon toba*, n. sp., allied to *simulator*.

1921*b*. Thomas described (p. 184) *Akodon sylvanus*, n. sp., allied to *arenicola hunteri*.

1921*d*. Thomas further described (p. 236) *surdus* and recorded 86 specimens of an *Akodon* which he referred to *boliviensis* Meyen.

He considered (p. 240) that Osgood's (1914) key to the subspecies of "*mollis*" showed in reality those differences in the zygomatic plates which he (Thomas) considered as of

generic value in distinguishing *Microxus* from *Akodon.* In consequence he concluded that *Akodon mollis orientalis* Osgood was almost if not quite equivalent to *Microxus torques* Thomas.

He concluded by stating that the reduced eyes and long head visible in spirit specimens of *Microxus* showed it to be quite distinct from *Akodon.*

1924. Anthony suspected (p. 4) *Microxus affinis* Allen to be an *Akodon* (see *Microxus*).

1925*a*. Thomas indicated (p. 579) that *obscurus, lenguarum, benefactus, lactens,* and *orbus* belonged in a single group; and that *glaucinus* and *simulator* might be subspecies of *varius.*

He described (p. 579) *Akodon sylvanus pervalens,* n. subsp.

1926*b*. Thomas stated (p. 317) that his "*Hesperomys* (*Habrothrix*) *xanthorhinus*" of 1884 should be corrected to *Akodon puer.*

1926*c*. Thomas commented (p. 322) upon *tartareus* and *pacificus.*

He suggested (pp. 322–323) that his *sylvanus pervalens* might be quite distinct from *sylvanus* and closer to *tartareus.*

1926*d*. Thomas, after stating that certain specimens which he had named *cænosus* were really *tucumanensis,* wrote (p. 604): "Most readily to distinguish skulls of the three *Akodons* [*varius simulator, tucumanensis* and *cænosus*] in the present collection, dividers may be set at 3.2 mm., a dimension which will approximately fit the first molar+half the second of *A. varius simulator,* the two first molars of *tucumanensis* and the whole row of *cænosus.*"

He referred *lactens* (1918) to *Bolomys.*

1926*f*. Thomas described (p. 636) *Akodon nucus* n. sp., "most allied to the latter [*iniscatus*]."

1926. Cabrera described (p. 320) *Akodon leucolimnaeus,* n. sp., from Laguna Blanca, Catamarca. (Not to be confused with Lago Blanco, type locality for *iniscatus.*)

1927*a*. Thomas transferred (p. 370) *Microxus torques* to *Akodon* (see also *Microxus*).

1927*b*. Thomas listed (pp. 550–551) the British Museum lectotypes of *Akodon* as follows:

obscurus	55.12.24.161, Maldonado, Uruguay, with lectoparatype 55.12.24.165, Maldonado.
olivaceus	55.12.24.200, Valparaiso, Chile, with lectoparatypes 55.12.24.160 and 164, Coquimbo, Chile.

canescens 55.12.24,157, Sta Cruz, Patagonia, with lectoparatype 55.12.24.173, Port Desire, Patagonia. "This latter is an immature *A. iniscatus* Thomas."
xanthorhinus 55.12.24.168 (with footnote correcting errors in Allen, 1905, and Thomas, 1919, p. 205), 55.12.24.158, Hardy Peninsula, Tierra del Fuego, with lectoparatype, 55.12.24.168.

1927*d*. Thomas remarked (pp. 204–205) that *neocenus* appeared to be nearest to *dolores* and compared it with *nucus*.

1929. Thomas wrote (p. 41) "I am now fairly satisfied that *A. canescens* should be united with *A. xanthorhinus* . . . " He gave (p. 42) distinguishing characters for *iniscatus* and *xanthorhinus*.

Microxus Thomas

1872. Hensel wrote of "*nasutus*" (p. 43), renamed *iheringi* by Thomas in 1896.

1886. Leche added remarks (p. 700) concerning "*nasutus*" of Hensel.

1891. Thomas in Milne-Edwards applied the name "*xanthorhinus*" to a skin and skull which in 1897 he redescribed as *lanosus*.

1895. Thomas described (p. 369) *Acodon bogotensis*, n. sp. (transferred in 1901 to *Oxymycterus* and in 1909 to *Microxus*).

1896*b*. Thomas described (p. 308) *Oxymycterus iheringi*, n. sp. (see Hensel, 1872, and Leche, 1886). He added that it was atypical for *Oxymycterus* and probably near the fossil *talpinus* Winge (Lund?). He suggested its possible relationship to *Blarinomys*.

1897*b*. Thomas described (p. 218) *Oxymycterus lanosus*, n. sp., based upon a skin and skull identified by him in 1891 as *Hesperomys xanthorhinus* (an *Akodon*).

1901*a*. Thomas discussed (p. 184) *bogotensis* under the generic name *Oxymycterus*.

1905. Cabrera described (p. 15) *Oxymycterus delfini*, n. sp. (perhaps a *Microxus*).

1909. Thomas erected (p. 237) *Microxus*, n. g., with type *Oxymycterus mimus*, including in addition *iheringi*, *lanosus* and *bogotensis*.

1912. Osgood remarked (p. 52) upon specimens of *bogotensis* from Tama on the border of Colombia and Venezuela.

1912. J. A. Allen described (p. 89) *Microxus affinis*, n. sp., comparing it with *bogotensis*.

1916. J. A. Allen stated (p. 216) that *affinis* was much larger than *bogotensis* and in coloration nearer to *mimus*.

1917*a*. Thomas described (p. 3) *Microxus torques*, n. sp., "near *Microxus mimus*."

1921*d*. Thomas further described (p. 239) *torques*.

He emphasized the distinctness of *Microxus* from *Akodon* as shown by the long head and small eyes of the former, but admitted a certain amount of intergradation in the degree of slant of the zygomatic plate. He implied that *Akodon mollis orophilus* and *A. m. orientalis* of Osgood, 1914 (see *Akodon*), might in reality be *Microxus*. This view, I suspect, was based upon their anomalous zygomatic plates rather than upon other *Microxus*-like characters. (See also Thomas, 1927.)

1924. Anthony described (p. 3) *Microxus latebricola*, n. sp. He suspected (p. 4) *affinis* Allen to be an *Akodon*.

1926*c*. Thomas definitely removed (pp. 615–616) *orophilus* and *orophilus orientalis*, both described by Osgood (1913) as *Akodon*, to *Microxus*.

1927*a*. Thomas, following the advice of Hinton, more or less reversed (p. 370) his opinion of 1921 and 1926, and removed *orophilus* and *torques* to *Akodon*. However he maintained that *Microxus* was a good genus, retaining in it *mimus*, *bogotensis* and *lanosus*.

PODOXYMYS Anthony

1929. Anthony erected (p. 4) *Podoxymys*, n. g., with type *Podoxymys roraimæ*, n. sp.

LENOXUS Thomas

1900. J. A. Allen described (p. 224) *Oxymycterus apicalis*, n. sp.

1909. Thomas erected (p. 236) *Lenoxus*, n. g., with type *Oxymycterus apicalis* Allen.

OXYMYCTERUS Waterhouse

1801. Azara described (p. 94) RAT CINQUIÈME OU RAT ROUX, the basis of *Mus rufus* Desmarest (an *Oxymycterus*).

1802. Azara wrote concerning the same rat (p. 80) under the name HOCICUDO.

1819. Desmarest named (p. 62) the RAT ROUX of Azara *Mus rufus* (n. sp.).
1826. Wied described (p. 425) *Hypudæus dasytrichus* (n. sp.).
1830. Rengger gave his own observations (p. 230) on *rufus.*
1837. Waterhouse erected (p. 20) *Oxymycterus,* n. subg. of *Mus,* including in it (p. 16) *nasutus* (n. sp.)
1839. Waterhouse further described (p. 56) *nasutus.*
1842. Wagner described (p. 361) *Hesperomys* (*Oxymycterus*) *rostellatus* (n. sp.), stating that it was purchased from the nature dealer, Brandt.
1843. Pictet described (p. 211) *Oxymycterus hispidus,* n. sp.
1843. Wagner, under *Hesperomys* (*Oxymycterus*), listed (p. 514) *nasutus* and *rostellatus,* amplyfying the description of the latter. *Rufus,* whose home he described as "Paraguay in the neighborhood of Asuncion," was listed (p. 540) in *Hesperomys.*
1845. Schinz described (p. 179) *Mus hispidulus* (n. sp.), apparently a renaming of *hispidus* Pictet and therefore a synonym.
1847. Gay described (p. 108) *Oxymicterus* (*sic*) *scalops* (n. sp.) (a *Notiomys*) and transferred to *Oxymicterus* Waterhouse's *Hesperomys megalonyx* (a *Notiomys*).
1854. Burmeister commented upon (p. 183) "*rufus,*" including in its synonymy *rostellatus* and *dasytrichos* (*sic*).
1858. Philippi described (p. 303) *Oxymycterus valdivianus* (n. sp.) (a *Notiomys*).
1861. Tomes raised (p. 285) *Oxymicterus* (*sic*) to generic rank.
1872. Philippi described (p. 445) *Oxymycterus niger* (n. sp.), doubtfully referred by Osgood (1925, p. 121) to *Notiomys.*
1872. Hensel wrote of "*nasutus*" (p. 43) renamed *iheringi* by Thomas in 1896, comparing it with *Akodon arenicola.* It is now in *Microxus.*
1879. Burmeister wrote some generalized remarks (p. 215) upon "*nasutus.*"
1883. Pelzeln wrote of "*nasutus*" (p. 74), recording it from Ypanema, Brazil. He also recorded "*rufus*" from Ytararé, near Ypanema.
1884. Thomas defined (p. 450) *Oxymycterus,* subgenus of *Hesperomys,* listing as species *nasutus, hispidus,* and *rufus.*
1886. Leche added remarks (p. 700) concerning "*nasutus*" of Hensel, 1872.

1887. Winge wrote extensively (p. 36) upon "*Oxymycterus rufus* Desm."
1895. Thomas described (p. 369) *Acodon bogotensis*, n. sp. (listed in 1901 as an *Oxymycterus* and in 1909 as a *Microxus*).
1896*b*. Thomas described (p. 308) *Oxymycterus iheringi*, n. sp. (a *Microxus*).
1897*b*. Thomas described (p. 218) *Oxymycterus lanosus*, n. sp. (transferred in 1909 to *Microxus*).
1898. Trouessart placed *rostellatus* and *dasytrichos* in the synonymy of *rufus*, and *hispidulus* Schinz in the synonymy of *hispidus* Pictet.
1900*a*. Thomas described (p. 298) *Oxymycterus inca*, n. sp.
1900. J. A. Allen described (p. 223) *Oxymycterus juliacæ*, n. sp., near *inca*, and (p. 224) *Oxymycterus apicalis*, n. sp. (a *Lenoxus*).
1900. Philippi described several rats under "*Mus* (*Oxymycterus*)," which are referable to different genera.
1901*a*. Thomas described (p. 183) *Oxymycterus iris*, n. sp., which he compared with *inca* and *juliacæ*, and *Oxymycterus mimus*, n. sp., a "member of the group of small *Akodon*-like *Oxymycteri*, the nearest ally being *O. bogotensis* . . . (p. 184) the cranial characters show it to be a member of the group of *Oxymycteri* which contains *O. bogotensis* Thomas and *O. lanosus* Thomas." (In 1909 it was made type of *Microxus*.)
1901*b*. Thomas described (p. 530) *Oxymycterus roberti*, n. sp., comparing it with *nasutus*.
1902*a*. Thomas gave color notes (p. 62) upon *iheringi*.
1902*b*. Thomas described (p. 139) *Oxymycterus paramensis*, n. sp., allied to *roberti* of Minas Geraes.
1903*a*. Thomas described (p. 226) *Oxymycterus quaestor*, n. sp., "allied to *O. nasutus*." He compared it with *nasutus* and *hispidus* and with *O. rostellatus*.
1903*b*. Thomas described (p. 489) *Oxymycterus delator*, n. sp., a markedly distinct form.
1903. J. A. Allen described (p. 189) *Oxymycterus microtis*, n. sp. (a *Notiomys*).
1905. J. A. Allen re-characterized (p. 82) the genus *Oxymycterus*, comparing several of the species together. He gave further descriptions of *lanosus* and *microtis* (the latter according to Osgood, 1925, =*Notiomys michaelseni*).
1905. Cabrera described (p. 15) *Oxymycterus delfini*, n. sp. (perhaps a *Microxus*).

1909. Thomas, revising the *Oxymycterus* alliance of species, divided (pp. 235–239) *Oxymycterus* into three genera: *Oxymycterus* (restricted), *Lenoxus*, n. g., and *Microxus*, n. g.

Lenoxus contained only *apicalis*.

Microxus, with type *mimus*, contained also *bogotensis*, *lanosus* and *iheringi*.

He described *Oxymycterus angularis*, n. sp., allied to *hispidus* and *Oxymycterus judex*, n. sp., which he compared with *quæstor*.

1914. Thomas described (p. 244) *Oxymycterus platensis*, n. sp., "closely allied to *O. rufus*."

1916*d*. Thomas described (p. 478) *Oxymycterus doris*, n. sp., allied to *juliacæ* and *inca*.

1921*c*. Thomas described (p. 615) *Oxymycterus akodontius*, n. sp., which he compared with *paramensis*.

1925*a*. Thomas described (p. 580) *Oxymycterus paramensis jacentior*, n. subsp.

1931. Sanborn described (p. 1) *Oxymycterus misionalis*, n. sp.

Notiomys Thomas

1844. Waterhouse described (p. 154) *Hesperomys megalonyx*, n. sp.

1847. Gay described (p. 108) *Oxymicterus* (*sic*) *scalops* (n. sp.).

Note.—I have compared skulls of *Chrœomys pulcherrimus*, *Abrothrix longipilis*, and *Notiomys* species with that part of the skull of *scalops* shown in Gay's Pl. VI, fig. 3 and, both on the basis of the pattern of the teeth and of the wide flare of the zygoma from the zygomatic plate, I have concluded that *scalops* Gay must have been a *Notiomys*. Furthermore, the tail of *scalops* was far too short to be that of a *Chrœomys*.

1858. Philippi described (p. 303) *Oxymycterus valdivianus* (n. sp.) and remarked upon its nearness to *megalonyx*.

1872. Philippi described (p. 445) *Oxymycterus niger* (n. sp.), comparing it with *megalonyx*, *valdivianus*, and *scalops*.

1891. Thomas, in Milne-Edwards, described (p. 24) *Hesperomys* (*Notiomys*) *edwardsii* (n. sp.), *Notiomys* representing a new subgenus of *Hesperomys*.

1894. Thomas described (p. 362) *Acodon macronyx*, n. sp., comparing it with *valdivianus* and *niger*.

1896*a*. Thomas raised (p. 1020) *Notiomys* to generic rank.

1898. Trouessart listed (p. 540) only *edwardsii* in *Notiomys*. *Valdivianus*, *niger*, *megalonyx*, and *macronyx* were placed in *Akodon* (pp. 537, 538).

1898. Matschie commented upon (p. 4) *Hesperomys* (*Acodon*) *valdivianus* (Philippi) and described (p. 5) *Hesperomys* (*Acodon*) *michaelseni*, n. sp.

1900. Philippi described (p. 57) *Mus microtis*, a young specimen from Maule, Chile, with tail length 33 mm. and claws of the manus 5 mm. It was figured on Pl. xxv, fig. 2, and the tiny ears and large claws are easily noted.
This name, if referable to *Notiomys*, preoccupied *microtis* Allen (1903).

1903. J. A. Allen described (p. 189) *Oxymycterus microtis*, n. sp., preoccupied ? by *microtis* Philippi (1900).

1903*c*. Thomas erected (p. 242) *Chelemys*, n. subg. of *Akodon* with type *Hesperomys megalonyx* ("*Akodon megalonyx*") and described *Akodon* (*Chelemys*) *vestitus*, n. sp. He distinguished (p. 243) the new subgenus from *Notiomys*. He suggested that both *michaelseni* and *microtis* Allen belonged in *Notiomys*.

1905. J. A. Allen characterized (pp. 78–80) "*vestitus*" (renamed *vestitus alleni* by Osgood, 1925) and *michaelseni* under *Akodon* (*Chelemys*) and (p. 81) *edwardsii* under *Notiomys*.

1919*b*. Thomas proposed (p. 209) *Geoxus*, n. g., with type *Oxymycterus valdivianus* Philippi and described (p. 208) *Geoxus fossor*, n. sp.
He supported Allen's (1905) assertion that *microtis* Allen was not closely related to *Notiomys*, thus reversing his own opinion of 1903; and he linked *microtis*, *michaelseni*, and *valdivianus* together under *Geoxus*. On page 209 *Notoxus*, misprint for *Geoxus*, occurs.
He still considered (p. 207) *Chelemys* a distinct genus.

1925. Osgood revised (pp. 113–125) the genus *Notiomys*, placing *Chelemys* and *Geoxus* in its synonymy. He listed (p. 119) *microtis* Allen in the synonymy of *michaelseni* and questioningly *niger* in that of *megalonyx*.
He described *valdivianus araucanus*, n. subsp., *valdivianus chiloensis*, n. subsp., *connectens*, n. sp., and *vestitus alleni*, n. subsp. (this last based upon specimens determined by Allen, in 1905, as *vestitus*).

1927*b*. Thomas selected (p. 551) the lectotype of "*Chelemys megalonyx*," male, 44.10.7.37 of the British Museum collection, from Lake Quintero, Chile, with lectoparatype, 43.12.30.39, Lake Quintero.

1927*c*. Thomas described (p. 654) *Chelemys vestitus fumosus*, n. subsp., and *Chelemys angustus*, n. sp., allied to *Notiomys connectens*. He criticized (pp. 655–656) Osgood's union of *Chelemys*, *Notiomys*, and *Geoxus* in a single genus (mentioning that the type of *edwardsii* is now in the British Museum, No. 18. 12.21.1), and maintained that *Notiomys* was markedly distinct from *Chelemys* and *Geoxus*. But he admitted that the last two genera might be "annectant."

1929. Thomas recorded (p. 42) a well-made, well-measured specimen of *edwardsii*, commenting upon the "excessively small ears."

BLARINOMYS Thomas

1877. Winge described (p. 34) *Oxymycterus breviceps*, n. sp., based upon fossil material from a cavern in Lagoa Santa.

1896*b*. Thomas erected (p. 310) *Blarinomys*, n. g., to contain *Oxymycterus breviceps* Winge.
Goeldi had sent Thomas a recent specimen from near Rio de Janeiro, and on the basis of that animal Thomas drew up his specific description and set up his new genus.
It seems to me that *talpinus* Lund, whose humerus that author described (1841, p. 276) as distinctly fossorial in character, may belong in *Blarinomys*.

1902. Goeldi recorded (p. 167) the finding of his specimen of *Blarinomys breviceps* and reviewed the history of the genus.

PRESENT STATUS OF THE GENERA AND SUBGENERA

Genus *Thalpomys* Thomas	Type by original designation: *Mus lasiotis* Lund
Genus *Deltamys* Thomas	Type by original designation: *Deltamys kempi* Thomas
Genus *Thaptomys* Thomas	Type by original designation: *Hesperomys subterraneus* Hensel
Genus *Hypsimys* Thomas	Type by original designation: *Hypsimys budini* Thomas
Genus *Bolomys* Thomas	Type by original designation: *Akodon amœnus* Thomas
Genus *Chroeomys* Thomas	Type by original designation: *Akodon pulcherrimus* Thomas
Genus *Abrothrix* Waterhouse	Type by original designation: *Mus longipilis* Waterhouse
Genus *Scotinomys* Thomas	Type by original designation: *Hesperomys teguina* Alston

Genus *Akodon* Meyen	Type by monotypy: *Akodon boliviensis* Meyen
Subgenus *Akodon* Meyen	
Subgenus *Chalcomys* Thomas	Type by original designation: *Akodon ærosus* Thomas
Genus *Microxus* Thomas	Type by original designation: *Oxymycterus mimus* Thomas
Genus *Podoxymys* Anthony	Type by original designation: *Podoxymys roraimae* Anthony
Genus *Lenoxus* Thomas	Type by original designation: *Oxymycterus apicalis* Allen
Genus *Oxymycterus* Waterhouse	Type by monotypy: *Mus nasutus* Waterhouse
Genus *Notiomys* Thomas	Type by monotypy: *Notiomys edwardsi* Thomas
Genus *Blarinomys* Thomas	Type by original designation: *Oxymycterus breviceps* Winge

List of Named Forms with Type Localities

The method of grouping the species of large genera geographically has been used in this paper for the subgenus *Akodon* only. A map showing the geographical areas is reproduced herewith. For fuller definitions of the areas, the original paper (Amer. Mus. Novit., 1932, No. 579) should be consulted.

Thalpomys	
lasiotis (Lund)	Lagoa Santa, Brazil
Deltamys	
kempi Thomas	Isla Ella, delta of Rio Parana, Argentina
Thaptomys	
nigrita (Lichtenstein)	Region of Rio de Janeiro, Brazil
subterraneus subterraneus (Hensel)	In burrows in forest, Rio Grande do Sul, Brazil
subterraneus henseli (Leche)	Taquara do Mundo Novo, Rio Grande do Sul, Brazil (received from von Ihering)
Hypsimys	
budini Thomas	Leon, Jujuy, Argentina, 1500 m.
deceptor Thomas	Higuerilla, Dept. of Valle Grande, 10 miles east of Zenta Range and 20 km. east of town of Tilcara, Jujuy, Argentina, 2000 m.

Bolomys

When first he erected *Bolomys*, Thomas apparently considered it a rather distinct division of *Akodon*, inhabiting the higher parts of the southern Andes. His later remarks (see *Akodon*, 1925) to the effect that *lactens* and *orbus* belonged in a single group with *obscurus*, *lenguarum*, and *benefactus* seemed, however, to belie this. In 1926 he again wrote of *lactens*, a species from relatively low country, under the generic name

Bolomys. *Orbus* and *gossei* are only doubtfully referred by me to *Bolomys*.

Philippi's species *andinus*,[1] treated by Thomas as a *Bolomys*, was described as having the long claws, dark dorsal color, and Andean distribution of that genus. His figure, however, rather resembles a subadult *Abrothrix longipilis*.

andinus (Philippi)	High Andes, of Prov. of Santiago, Chile
albiventer (Thomas)	Lower Cachi, Prov. of Salta, Argentina
berlepschii (Thomas)	Esperanza, Mt. Sahama, Bolivia, 4000 ft.
amœnus (Thomas)	Calalla, Rio Colca, near Sumbay, Peru, 3500 m.
jucundus (Thomas)	Cerro de la Lagunita, east of Maimara, Jujuy, Argentina, 4500 m.
lactens (Thomas)	Leon, Jujuy, Argentina, 1500 m.
orbus (Thomas)	Otro Cerro (45 kilometers west of Chumbicha), Rioja, Argentina, 3000 m.
gossei (Thomas)	Puente del Inca, Andes of Mendoza, Argentina, 10,000 ft.
negrito Thomas	Las Paras, Aconquiza, Tucuman, Argentina, 4000 m.

Chrœomys

Akodon-like mice, colored dark fuscous brown, white, and chestnut, which inhabit the high Andes of Peru, Bolivia, and northern Chile.

jelskii jelskii (Thomas)	Junin, Central Peru.
jelskii pyrrhotis (Thomas)	Maraynioc, Central Peru.
pulcherrimus (Thomas)	Puno, Peru, 4000 m.
pulcherrimus caylloma (Thomas)	Caylloma, southeast Peru, 4300 m.
pulcherrimus inambarii (Thomas)	Limbane, Inambari River, upper River Madre de Dios, southeast Peru, 3400 m.
pulcherrimus cruceri (Thomas)	Crucero, on pass between Puno and upper Inambari River, southeast Peru, 4550 m.
bacchante bacchante (Thomas)	Choro, northwest of Cochabamba, Bolivia, 3500 m.
bacchante sodalis (Thomas)	Cerro de la Langunita, east of Maimara, Jujuy, Argentina, 4500 m.
inornatus Thomas	Ollantaytambo, Cuzco Region, Peru, 13,000 ft.

Abrothrix

This genus, as restricted by Thomas in 1916, represents a group of medium to large-sized akodonts inhabiting the lowlands (excepting *illutea*) of Chile and Argentina, adjoining the Andes. Probably the greatest altitude reached by most members of the genus is 4000 ft.

[1]It is doubtful whether Thomas thought of *andinus* and *gossei* as *Bolomys*. He compared them with *jucundus* which in 1913 he had compared with *alviventer* and *puer*.

longipilis (Waterhouse)	Coquimbo, Chile
brachiotis (Waterhouse)	On a little island near Midship Bay, Chonos Archipelago, Chile
brevicaudata (Philippi)	Puerto Montt, Valdivia, Chile
hirta hirta (Thomas)	Fort San Rafael, Mendoza, Argentina
hirta suffusa (Thomas)	Valle del Lago Blanco, Cordillera region of southern Chubut, Argentina
hirta modestior Thomas	Maiten, upper Chubut River, 42° S., 71° W., Argentina
hirta mœrens Thomas	Beatriz, Nahuel Huapi, Nequen, Argentina, 800 m.
hirta nubila Thomas	Estancia, Alta Vista, Lago Argentino, Santa Cruz, Argentina, 600 m.
francei (Thomas)	Santa Maria, Tierra del Fuego.
illutea Thomas	Concepcion, Tucuman, Argentina, 400 m. (corrected in 1929 to 3000–4000 meters)
Scotinomys	
teguina teguina (Alston)	Coban, Guatemala
teguina apricus (Bangs)	Boquete, Chiriqui, Panama, 4000 to 5000 ft.
xerampelinus (Bangs)	Volcan de Chiriqui, Panama, 10,300 ft.
irazu (Allen)	Volcan de Irazu, Costa Rica

Akodon (*Chalcomys*)

In the subgenus *Chalcomys* we have apparently a group of akodonts of the humid subtropics, rather closely confined to the forested eastern slopes of the Andes, except in Colombia, where it occurs in the valleys of the Cauca and Magdalena rivers and in eastern Venezuela and Trinidad, where it descends in suitable environments almost to sea-level. A *Chalcomys* is present on the upper parts of Mts. Duida and Roraima of the Guyana Mountains. On the Pacific side of the Andes it seems to be replaced by the very similar-appearing *Oryzomys* (*Melanomys*).

I feel fairly convinced that *dayi* is a *Chalcomys*. The extension of distribution into eastern Bolivia suggests that one or more of the akodonts of Brazil—*fuliginosus*, *caniventer*, etc.,—may ultimately be shown to belong in *Chalcomys*.

urichi Allen and Chapman	Caparo, Trinidad
venezuelensis Allen	Quebrada Seca, near Cumana, Prov. Sucre, Venezuela
meridensis Allen	Mérida, Venezuela, 1630 m.
tolimæ Allen	Rio Toché, Quindio Andes, Tolima, Colombia, 7000 ft.
chapmani Allen	Chipaque, Eastern Andes, Colombia, 8500 ft.
ærosus ærosus Thomas	Mirador, Baños, Ecuador, 1500 m.
ærosus baliolus Osgood	Inca Mines, Inambari River, Peru
dayi Osgood	Todos Santos, Chaparé River, Bolivia

Akodon (Akodon)

It will be seen that with the exception of the *mollis* group, which extends north of the equator along the Andes and along the western coastal strip of South America, the subgenus *Akodon* is almost confined to the southern half of South America and is excluded apparently from Amazonia (Region 6). However I have collected a species of *Akodon* just east of Pará.

Due to the conflicting views held from time to time by Thomas concerning the probable relationships of the species of *Akodon*, I have been unable to reach any definite conclusion regarding his groups of species, although such doubtless will be worked out eventually. Accordingly, I have again listed them under general regional headings with the hope that in this way some relationships at least may be suggested.

Region 3 (Andes north of Chile)[1]

punctulatus Thomas	Pallatanga (?) Ecuador
mollis altorum Thomas	Cañar, Prov. Azuay, Ecuador
mollis orophilus Osgood	Six miles west of Leimabamba (in mountains near headwaters of Utcubamba River), Peru
mollis orientalis Osgood	Poco Tambo, between Chachapoyas and Rioja, Peru, 6000 ft.
surdus Thomas	Huadquiña, Cuzco Region, Peru, 5000 ft.
boliviensis Meyen	Village of "Pichu-pichun," western cordillera, Peru, 14,000 ft. (Probably on Mt. Pichu-pichu, near Arequipa)
lutescens Allen	Tirapata, Peru, 15,000 ft.

Region 4 (coast, from Ecuador to northern Chile)

mollis mollis Thomas	Tumbez, northwestern Peru

Region 7 (Ceará to Matto Grosso and northern Chaco, Jujuy, etc.)

cursor (Winge)	Lagoa Santa, Brazil
lenguarum Thomas	Waikthlatingmayalwa, northern Chaco, Paraguay
toba Thomas	Jesematathla, northern Chaco, Paraguay, 100 m.

Region 8 (southern Brazil and Paraguay)

fuliginosus (Wagner)	Ypanema, São Paulo, Brazil
serrensis serrensis Thomas	Roça Nova, on railway between Paranangua and Curitiba, Prov. Parana, Brazil, 1000 m.
serrensis leucogula (Ribeiro)	Retiro de Ramos, Serra Itatiaya, São Paulo, Brazil
caniventris (Wagner)	Brazil
montensis Thomas	Sapucay, Paraguay

[1]For explanation and map of geographical regions, see Amer Mus. Novitates, No. 579, 1932, pp. 12–14.

Region 9 (Pampas)

arenicola arenicola (Waterhouse)	Maldonado, Uruguay
arenicola hunteri Thomas	Isla Ella, delta of Rio Parana, Argentina
obscurus (Waterhouse)	Maldonado, Uruguay
azaræ (Fischer)	32½° S (=latitude of Entre Rios) Argentina
benefactus Thomas	Bonifacio, southwest Buenos Ayres Province, Argentina
dolores Thomas	Yacanto, near Villa Dolores, southwestern slopes of Sierra de Cordova, Argentina, 900 m.
glaucinus Thomas	Chumbicha, 60 kilom. southwest of Catamarca, Argentina, 600 m.
cænosus Thomas	Leon, Jujuy, Argentina, 1500 m.
sylvanus sylvanus Thomas	Sunchal, Sierra de Santa Barbara, southeastern Jujuy, Argentina, 1200 m.
sylvanus pervalens Thomas	Carapari, 35 km. north of Yacuiba, Tarija, Bolivia, 1000 m.
tartareus Thomas	Tartagal, Salta, Argentina, 600 m.
tucumanensis Allen	Tucuman, Argentina
spegazzinii Thomas	Lower Cachi, Prov. Salta, Argentina
nucus Thomas	Chos Malal, 37° S., Nequen, Argentina
neocenus Thomas	Rio Limay, Rio Negro, Nequen, Patagonia
iniscatus iniscatus Thomas	Valle de Lago Blanco, Koslowsky region, Patagonia, 46° S.
iniscatus collinus Thomas	Maiten, West Chubut, Argentina, 700 m.

Region 10 (slopes of the southern Andes at high altitudes)

fumeus Thomas	Choro, northwest of Cachabamba, Bolivia, 3500 m.
puer Thomas	Choquecamate, northwest of Cochabamba, Bolivia, 4000 m.
pacificus Thomas	La Paz, Bolivia, 4000 m.
varius varius Thomas	Tapacari, west of Cochabamba, Bolivia, 3000 m.
varius simulator Thomas	Villa Nouges, San Pablo, Tucuman, Argentina, 1200 m.
rupestris (Gervais) ?	High mountains of Cobija, Bolivia
leucolimnaeus Cabrera	Laguna Blanca, Catamarca, Argentina, 3100 m.
alterus Thomas	Chumbicha, 60 km. southwest of Catamarca, Argentina
beatus Thomas	Beatriz, Nahuel Huapi, north western Patagonia

Region 11 (Chilean lowlands)

olivaceus (Waterhouse)	Valparaiso, Chile
pusillus (Philippi)[1]	Valparaiso, Chile
brevicaudatus (Philippi)[1]	Puerto Montt, Chile

[1]Probably synonyms of *olivaceus*.

Region 12 (arid southern Patagonia)

canescens (Waterhouse)	Port Desire, Patagonia
xanthorhinus (Waterhouse)	Santa Cruz, Patagonia

Microxus

It is difficult to understand how such strongly akodont species as *torques*, *bogotensis*, and *affinis* were originally placed in *Oxymycterus* (*sensu lato*) rather than in *Akodon*. Once this had been done, however, it was inevitable that species which differed so markedly from the truly oxymycterine genera *Oxymycterus* (*sensu stricto*) and *Lenoxus* should very soon be set off from those as a separate genus. Thus *Microxus* was erected. Most of the discussion of recent years hinges upon efforts to keep separate the two groups *Akodon* (*sensu lato*) and *Microxus*, which obviously are very close allies.

If we abandon the idea that the species in question are intimately related to *Oxymycterus*, we can readily see that they fit closely into the *Akodon* complex. Considered in this way, the dark-colored *affinis* of Colombia appears to be a *Chalcomys*, and *torques*, *orophilus*, and *orientalis* of Peru seem to belong in the *mollis* group. Furthermore, it will be noted that in 1927 Thomas reached the conclusion that *torques* should be removed to *Akodon*. Perhaps that character which has been chiefly invoked to separate *Microxus* from *Akodon* and to ally it with *Oxymycterus*—the slope of the zygomatic plate—is less important than it appeared to be at first sight. In listing the species, however, I have provisionally left *torques* and *affinis* in *Microxus*.

iheringi (Thomas)	Taquara, Rio Grande do Sul, Brazil
lanosus (Thomas)	Monteith Bay, Straits of Magellan
mimus (Thomas)	Limbane, Dept. of Puno, Peru, 2600 m.
bogotensis (Thomas)	Plains of Bogotá, Colombia
affinis Allen	San Antonio, near Cali, Cauca, Colombia, 8000 ft.
torques Thomas	Matchu Picchu, Cuzco Region, Peru, 10,000 ft.
latebricola Anthony	Hacienda San Francisco, east of Ambato, on Rio Cusutagua, Ecuador, 8000 ft.
delphini (Cabrera)	Punta Arenas, Patagonia

Podoxymys

roraimæ Anthony	Summit of Mt. Roraima, British Guiana

Lenoxus

apicalis (Allen)	Juliaca, Peru, 6000 ft.

Oxymycterus

This genus (*sensu stricto*) appears to extend from the coast of Brazil (from Pernambuco southwards to Uruguay), across the Matto Grosso

and Chaco country to the Andes of Central Peru, Bolivia, and northern Argentina. True *Oxymycterus* appears to be absent from Chile.

angularis Thomas	São Lourenço, near Pernambuco, Brazil
dasytrichus (Wied)	Type locality not fixed. One specimen from R. Mucuri; another from Camamu, south of and not far from Bahia de Todos Santos, Brazil
rostellatus (Wagner)	Eastern Brazil
quaestor Thomas	Roça Nova, on railway between Paranangua and Curitiba, Prov. Parana, Brazil, 1000 m.
roberti Thomas	Rio Jordao, district of Araguary, southwest Minas Geraes, Brazil
hispidus (Pictet)	Bahia, Brazil
judex Thomas	Joinville, Santa Catharina, Brazil
nasutus (Waterhouse)	Maldonado, Uruguay
platensis Thomas	Ensenada, Rio Santiago, La Plata, Argentina
rufus (Desmarest)	No definite locality. Taken near a stream. Another specimen, Azara's HOCICUDO (1802) was shot in an arroyo in Entre Rios, Argentina
delator Thomas	Sapucay, Paraguay
doris Thomas	Charuplaya, upper Mamoré River, 65° 5′ W., 16° S., Bolivia, 1350 m.
iris Thomas	San Ernesto, near Mapiri, Mapiri River, upper Beni River, Bolivia, 1000 m.
inca Thomas	Perené River, Ucayali watershed, Dept. of Junin, Peru, 800 m.
juliacæ Allen	Juliaca, Peru
paramensis paramensis Thomas	Choquecamate, northwest of Cochabamba, Bolivia, 4000 m.
paramensis jacentior Thomas	Carapari, 35 km., north of Yacuiba, Tarija, Bolivia, 1000 m.
akodontius Thomas	Higuerilla, Dept. Valle Grande, 10 km. east of Zenta Range and 20 km. east of towns of Tilcara, Jujuy, Argentina, 2000 m.
misionalis Sanborn	Caraguatay, R. Paranay, Prov. Misiones, Argentina

Notiomys (including *Chelemys* and *Geoxus*)

scalops (Gay)	In fields in the Central Provinces, Chile
megalonyx (Waterhouse)	Lake Quintero, Chile
valdivianus valdianus (Philippi)	Near Valdivia, Chile
valdivianus chiloensis Osgood	Quellon, Chiloe Island, Chile
valdivianus araucanus Osgood	Tolhuaca, Prov. Malleco, Chile
niger (Philippi)	Peine, Prov. of Peine, Chile
macronyx (Thomas)	Near Fort San Rafael, Prov. of Mendoza, Argentina
edwardsii Thomas	South of Santa Cruz, towards 50° S. lat., Patagonia

michaelseni (Matschie)	In mountain forest, Punta Arenas, Patagonia
vestitus vestitus (Thomas)	Valle del Lago Blanco, cordillera region of southern Chubut Territory, Patagonia
vestitus alleni Osgood	Upper Rio Chico, Santa Cruz, S. Argentina
vestitus fumosus (Thomas)	Sierra de Pilpil, 15 km. south of San Martin, 40° 15′ S., 71° 20′ W. southwest Nequen Territory Argentina, 1200–2000 m.
microtis Philippi	Prov. Maule, Chile
microtis Allen (preoccupied by *microtis* Philippi?)	Pacific slope of cordillera, near headwaters of Rio Chico de Santa Cruz, Patagonia
fossor (Thomas)	Maiten, Western Chubut, Argentina, 700 m.
connectens Osgood	Villa Portales, Prov. Cautin, Chile
angustus (Thomas)	Bariloche, east of Lake Nahuel Huapi, Nequen, Argentina, 800 m.
Blarinomys Thomas	
breviceps (Winge)	Fossil skull: in caves at Lagoa Santa, Brazil. Recent specimen: Colonia Alpina, Theresopolis, Rio de Janeiro, Brazil

LIST OF REFERENCES

Allen, J. A.	1899.	Bull. Amer. Mus. Nat. Hist., XII, pp. 195–218.
	1900.	Bull. Amer. Mus. Nat. Hist., XIII, pp. 219–227.
	1901.	Bull. Amer. Mus. Nat. Hist., XIV, pp. 41–46.
	1903.	Bull. Amer. Mus. Nat. Hist., XIX, pp. 185–196.
	1904*a*.	Bull. Amer. Mus. Nat. Hist., XX, pp. 29–80.
	1904*b*.	Bull. Amer. Mus. Nat. Hist., XX, pp. 327–335.
	1905.	'Report Princeton Pat. Exped.,' III, (1).
	1913*a*.	Bull. Amer. Mus. Nat. Hist., XXXII, pp. 469–484.
	1913*b*.	Bull. Amer. Mus. Nat. Hist., XXXII, pp. 597–602.
	1916.	Bull. Amer. Mus. Nat. Hist., XXXV, pp. 191–238.
Allen, J. A., and Chapman, F. M.	1893.	Bull. Amer. Mus. Nat. Hist., V, pp. 203–234.
	1897.	Bull. Amer. Mus. Nat. Hist., IX, pp. 13–30.
Anthony, H. E.	1924.	Amer. Mus. Novit., No. 139.
Azara, F.	1801.	'Essais Hist. Nat. Quadr. Paraguay,' II.
	1802.	'Apuntamientos Hist. Nat. Quadr. Paraguay y Rio de la Plata,' II.
Bangs, O.	1902.	Bull. Mus. Comp. Zool., XXXIX, pp. 17–51.
Bridges, T.	1843.	Proc. Zool. Soc. London.
Burmeister, H.	1854.	'Syst. Ubersicht Thiere Brasilien.'
	1855.	Abh. Naturf. Ges. Halle, II (1), (1854), Sitz.
	1879.	'Descrip. Phys. Rep. Argentina,' III.
Cabrera, A.	1905.	Rev. Chilena Hist. Nat., IX.
	1926.	Rev. Chilena Hist. Nat., XXX.
Desmarest, A. G.	1819.	Nouv. Dict. d'Hist. Nat., 2nd Ed., XXIX.
Fischer, J. B.	1829.	'Synopsis Mammalium.'
Gay, C.	1847.	'Hist. Fis. y. Politica de Chile.' Zoologia, I.
Gervais, P.	1841.	In Eydoux and Soulevet. 'Voyage autour du Monde . . . sur . . . La Bonite,' I—Mammiferes.
Goeldi, E. A.	1902.	Bol. Mus. Paraense, III, pp. 166–169.
Gray, J. E.	1843.	'List Spec. Mamm. Brit. Mus.'
Hensel, R.	1872.	Abh. Ak. Wiss. Berlin.
Ihering, H. von	1893.	'Os Mammiferos do Rio Grande do Sul.' Annuario do Estado do Rio Grande do Sul, para o anno 1893, de Graciano a de Azambuja.
Leche, W.	1886.	Zool. Jahrb., I.
Lichtenstein, H.	1827.	'Darstellung neue oder wenig bekannter Säugethiere.'
Lund, P.	1841.	Afh. k. d. Vidensk. Selsk. . . . Skrifter, VIII.
Matschie, P.	1898.	'Ergebnisse der Hamburger Magalhaenischen Sammelreise 1892–3.' Band I. Säugethiere.
Meyen, F. J. F.	1832.	Nova Acta Ac. Leop., XVI.
Milne-Edwards, A.	1891.	'Mission Sci. Cap. Horn,' VI (1).
Osgood, W. H.	1912.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 33–66.
	1914.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 143–185.
	1915.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 187–198.
	1916.	Field Mus. Nat. Hist., Zool., Ser., X, pp. 199–216.
	1925.	Field Mus. Nat. Hist., Zool., Ser. XII, pp. 113–125.

PALMER, T. S.	1904.	North American Fauna, No. 23.
PELZELN, A. VON	1883.	Verh. Zool. Bot. Ges. Wien, XXXIII, Beiheft.
PHILIPPI, R. A.	1858.	Arch. f. Naturg., I.
	1872.	Zeitschr. gesammten Naturwiss., New Series, VI.
	1900.	Anales Mus. Nac. Chile, No. 14.
PICTET, F.-J.	1843.	Mem. Soc. Phys. Hist. Nat. Geneve, X.
RENGGER, J. R.	1830.	'Naturg. Saug. Paraguay.'
RIBEIRO, A. DE M.	1905.	Arch. Mus. Rio de Janeiro, XIII, pp. 174–188.
SANBORN, C. C.	1931.	Proc. Biol. Soc., Wash., XLIV, p. 1.
SCHINZ, H.	1845.	'Syst. Verzeichn. Saug. oder Synopsis Mamm.,' II.
THOMAS, O.	1884.	Proc. Zool. Soc. London.
	1894.	Ann. Mag. Nat. Hist., (6) XIV, pp. 346–366.
	1895.	Ann. Mag. Hat. Hist., (6) XIV, pp. 367–370.
	1896*a*.	Proc. Zool. Soc. London, pp. 1012–1028.
	1896*b*.	Ann. Mag. Nat. Hist., (6) XVIII, pp. 301–314.
	1897*a*.	Ann. Mag. Nat. Hist., (6) XIX, pp. 494–501.
	1897*b*.	Ann. Mag. Nat. Hist., (6) XX, pp. 214–218.
	1897*c*.	Ann. Mag. Nat. Hist., (6) XX, pp. 218–221.
	1897*d*.	Ann. Mag. Nat. Hist., (6) XX, pp. 544–552.
	1898*a*.	Proc. Zool. Soc. London, pp. 210–212.
	1898*b*.	Ann. Mag. Nat. Hist., (7) I, pp. 277–283.
	1898*c*.	Ann. Mag. Nat. Hist., (7) II, pp. 265–275.
	1900*a*.	Ann. Mag. Nat. Hist., (7) VI, pp. 294–302.
	1900*b*.	Ann. Mag. Nat. Hist., (7) VI, pp. 466–469.
	1901*a*.	Ann. Mag. Nat. Hist., (7) VII, pp. 179–190.
	1901*b*.	Ann. Mag. Nat. Hist., (7) VIII, pp. 526–536.
	1902*a*.	Ann. Mag. Nat. Hist., (7) IX, pp. 59–64.
	1902*b*.	Ann. Mag. Nat. Hist., (7) IX, pp. 125–143.
	1902*c*.	Ann. Mag. Nat. Hist., (7) IX, pp. 222–230.
	1903*a*.	Ann. Mag. Nat. Hist., (7) XI, pp. 226–229.
	1903*b*.	Ann. Mag. Nat. Hist., (7) XI, pp. 487–493.
	1903*c*.	Ann. Mag. Nat. Hist., (7) XII, pp. 234–243.
	1908.	Ann. Mag. Nat. Hist., (8) II, pp. 496–497.
	1909.	Ann. Mag. Nat. Hist., (8) IV, pp. 230–242.
	1913*a*.	Ann. Mag. Nat. Hist., (8) XI, pp. 136–143.
	1913*b*.	Ann. Mag. Nat. Hist., (8) XI, pp. 404–409.
	1914.	Ann. Mag. Nat. Hist., (8) XIV, pp. 240–244.
	1916*a*.	Ann. Mag. Nat. Hist., (8) XVII, pp. 182–187.
	1916*b*.	Ann. Mag. Nat. Hist., (8) XVIII, pp. 334–336.
	1916*c*.	Ann. Mag. Nat. Hist., (8) XVIII, pp. 336–340.
	1916*d*.	Ann. Mag. Nat. Hist., (8) XVIII, pp. 478–480.
	1917*a*.	Smiths. Misc. Coll., LXVIII, No. 4.
	1917*b*.	Ann. Mag. Nat. Hist., (8) XX, pp. 95–100.
	1918	Ann. Mag. Nat. Hist., (9) I, pp. 186–193.
	1919*a*.	Ann. Mag. Nat. Hist., (9) III, pp. 115–118.
	1919*b*.	Ann. Mag. Nat. Hist., (9) III, pp. 199–212.
	1919*c*.	Ann. Mag. Nat. Hist., (9) III, pp. 213–214.
	1919*d*.	Ann. Mag. Nat. Hist., (9) III, pp. 489–500.

THOMAS, O.	1919*e*.	Ann. Mag. Nat. Hist., (9) IV, pp. 154–156.
	1920*a*.	Ann. Mag. Nat. Hist., (9) V, pp. 188–196.
	1920*b*.	Ann. Mag. Nat. Hist., (9) VI, pp. 417–422.
	1921*a*.	Ann. Mag. Nat. Hist., (9) VII, pp. 177–179.
	1921*b*.	Ann. Mag. Nat. Hist., (9) VII, pp. 183–187.
	1921*c*.	Ann. Mag. Nat. Hist., (9) VIII, pp. 608–617.
	1921*d*.	Proc. U. S. Nat. Mus., LVIII, pp. 217–249.
	1925*a*.	Ann. Mag. Nat. Hist,. (9) XV, pp. 575–582.
	1925*b*.	Ann. Mag. Nat. Hist., (9) XV, pp. 582–586.
	1926*a*.	Ann. Mag. Nat. Hist., (9) XVII, pp. 311–312.
	1926*b*.	Ann. Mag. Nat. Hist., (9) XVII, pp. 313–318.
	1926*c*.	Ann. Mag. Nat. Hist., (9) XVII, pp. 318–328.
	1926*d*.	Ann. Mag. Nat. Hist., (9) XVII, pp. 602–609.
	1926*e*.	Ann. Mag. Nat. Hist., (9) XVII, pp. 610–616.
	1926*f*.	Ann. Mag. Nat. Hist., (9) XVIII, pp. 635–641.
	1927*a*.	Ann. Mag. Nat. Hist., (9) XIX, pp. 361–373.
	1927*b*.	Ann. Mag. Nat. Hist., (9) XIX, pp. 545–554.
	1927*c*.	Ann. Mag. Nat. Hist., (9) XIX, pp. 650–658.
	1927*d*.	Ann. Mag. Nat. Hist., (9) XX, pp. 199–205.
	1929.	Ann. Mag. Nat. Hist., (10) IV, pp. 35–45.
TOMES, R. F.	1865.	Proc. Zool. Soc. London.
TROUESSART, E.-L.	1898.	'Cat. Mamm. viv. foss.'
	1905.	'Cat. Mamm. viv. foss.,' Supplement.
TSCHUDI, J. J. VON	1845.	'Untersuchungen Fauna Peruana,' I (1844).
WAGNER, A.	1842.	Arch. f. Naturg., I.
	1843.	'Schreber's Saugethiere,' Supplement III.
	1845.	Arch. f. Naturg., I.
	1850.	Abh. Ak. München, V.
WATERHOUSE, G. R.	1837.	Proc. Zool. Soc. London.
	1839.	'Zool. Voy. "Beagle."'
	1844.	Proc. Zool. Soc. London.
WIED, M.	1826.	'Beiträge z. Naturg. v. Brasilien,' II.
WINGE, H.	1887.	E. Mus. Lundii, I, pt. 3.
WOLFFSOHN, J. A.	1910.	Bol. Mus. Nac. Chile, II, pp. 84–102.

AMERICAN MUSEUM NOVITATES

Number 583 | Published by The American Museum of Natural History New York City | Nov. 14, 1932

59.9, 32 C (801)

THE TAXONOMIC HISTORY OF CERTAIN SOUTH AND CENTRAL AMERICAN CRICETID RODENTIA: *NEOTOMYS*, WITH REMARKS UPON ITS RELATIONSHIPS; THE COTTON RATS (*SIGMODON* AND *SIGMOMYS*); AND THE "FISH-EATING" RATS (*ICHTHYOMYS*, *ANOTOMYS*, *RHEOMYS*, *NEUSTICOMYS*, AND *DAPTOMYS*)

By G. H. H. Tate

This is the seventh paper of this series. I have purposely left untreated the northern genera *Onychomys*, *Peromyscus*, *Reithrodontomys*, and *Neotoma*, and their allies, which have been exhaustively monographed in fairly recent times.

HISTORICAL STATEMENT[1]

Neotomys Thomas

1894. Thomas erected (p. 346) *Neotomys*, n. g., to contain *Neotomys ebriosus*, n. sp., suggesting its nearness to *Sigmodon* and to *Sigmomys alstoni*.

1900. Thomas gave (p. 299) color notes upon *Neotomys ebriosus* from Galera, about fifty miles west southwest of the type locality. The distribution of this animal, which is a form inhabiting the sub-paramo, is probably continuous between the two places.

1905. Trouessart placed (p. 428) *Neotomys* between his *Eligmodontia* and *Reithrodon*.

1921*b*. Thomas described (p. 612) *Neotomys vulturnus*, n. sp. "Altogether the differences do not amount to very much; but, in view of the wide difference in locality, I consider it best for the present to distinguish *vulturnus* as a species rather than subspecies." In the introduction (p. 608) Thomas styled it a "swamp rat."

1926. Thomas again recorded (p. 322) *Neotomys vulturnus*.

[1] A copy of the newly published 'A Manual of Neotropical Sigmodont Rodents,' by Nils Gyldenstolpe (Kungl. Svenska Vetenskapsakad. Handlingar, (3) XI, No. 3, pp. 1–164 and plates, 1932) has just been received. This work should be consulted for each cricetid genus. It reached my hands too late to receive treatment under the generic headings.

NOTE.—When laying out the work for the series of papers which I have nearly completed, I assumed that I should have to deal with *Neotomys* after reaching the akodont division. This idea turned out to be entirely erroneous, for *Neotomys* proves to be the closest known ally, not excepting *Euneomys*, of *Reithrodon*. Accordingly it is treated as a genus apart from others handled in this paper.

That it is a member of the *Phyllotis-Reithrodon* complex is evident from the very large, rounded infra-orbital canal cutting backward between the muzzle and the maxillary root of the zygoma, the narrowed, square-edged interorbital region, and the tendency to bridge over the posterior narial opening through modification of the palatines and of the pterygoid region. I see no evidence of near relationship to *Sigmodon*, as affirmed by Thomas (1894).

Both *Neotomys* and *Reithrodon* are markedly distinct from *Phyllotis* and *Auliscomys* (I have not seen *Euneomys*) in the following characters:

1. Peculiarity of the anterior palatal foramina.
2. Strongly narrowed and furrowed palate.
3. Forward-projecting spinous process of the zygomatic plate.
4. *Cricetus*-like molars.

Notwithstanding the above resemblances, *Neotomys* and *Reithrodon* diverge from one another in the structure of their pterygoid regions and in the fact that the habitus of *Neotomys* is muroid, while that of *Reithrodon* is cuniculoid—indeed the latter parallels *Ochotona* in not a few ways, while the former is *Akodon*-like.

THE COTTON RATS

SIGMODON Say and Ord

Note.—Excepting the type, only forms found south of the Mexican border are dealt with.

1825. Say and Ord described (pp. 352–355) *Sigmodon hispidus*, n. g. and n. sp.

1855. Burmeister described (1854, pp. 15–17) *Lasiomys hirsutus* (n. sp.). See Thomas, 1914.

1855. Baird described (p. 333) *Sigmodon berlandieri*, n. sp., early synonymized with *hispidus* but reinstated by Bailey, 1902, as a subspecies.

1859. Baird wrote (p. 501) a full description of the genus *Sigmodon* and further described (p. 504) *berlandieri*.

1860. DeSaussure proposed (p. 98) *Deilemys*, "1^er^ groupe" of "*Hesperomys* Waterhouse" to contain the single species *H. toltecus* (n. sp.). *Deilemys* was a synonym of *Sigmodon*.

1874. Coues recharacterized (p. 175) the genus *Sigmodon*.

1876. Alston diagnosed (p. 84) the genus *Sigmodon*.

1877. Coues gave (p. 31) a full diagnosis of the genus *Sigmodon*.

1880. Alston, remarking upon *Sigmodon*, which he treated as a full genus, synonymized (p. 152) *toltecus* and *berlandieri* with *hispidus*.

1887. Winge discussed (p. 21) *Holochilus vulpinus* under the generic name *Sigmodon*.

1889. J. A. Allen described (p. 180) *Sigmodon fulviventer*, n. sp.

1891. J. A. Allen listed (p. 186) *berlandieri* as a subspecies of *hispidus*.

1897. Mearns described (p. 504) *Sigmodon hispidus eremicus*, n. subsp.

1897*a*. J. A. Allen described (p. 40) *Sigmodon borucæ*, n. sp.

1897*b*. J. A. Allen described (p. 54) *Sigmodon mascotensis*, n. sp., and (p. 55) *Sigmodon colimæ*, n. sp.

1897*c*. J. A. Allen described (p. 118) *Sigmodon peruanus*, n. sp.

1897*d*. J. A. Allen described (p. 121) *Sigmodon bogotensis*, n. sp.

1898. Bangs described (p. 189) *Sigmodon sanctæmartæ*, n. sp.

1898. Trouessart placed (pp. 522–523) part of *berlandieri* of Allen in the synonymy of *toltecus* and part in that of *colimæ*. He made *berlandieri* Baird a synonym of *hispidus*. *Lasiomys* Burmeister was made (p. 606) a synonym of the echimyid *Isothrix*.

1901. J. A. Allen described (p. 40) *Sigmodon simonsi*, n. sp.

1902. Bangs described (p. 32) *Sigmodon austerulus*, n. sp.

1902. Bailey, in a synopsis of the genus *Sigmodon*, described (from south of the Mexican border) (p. 109) *Sigmodon hispidus tonalensis*, n. subsp.; (p. 109) *S. hispidus major*, n. subsp.; (p. 111) *S. hispidus saturatus*, n. subsp.; (p. 111) *S. hispidus microdon*, n. subsp.; (p. 112) *Sigmodon alleni*, n. sp.; (p. 114) *Sigmodon melanotis*, n. sp.; (p. 115) *Sigmodon leucotis*, n. sp.; (p. 116) *Sigmodon alticola*, n. sp.; and *Sigmodon alticola amoles*, n. subsp.

Berlandieri and *toltecus* were recognized as subspecies of *hispidus*, and *borucæ* and *mascotensis* were reduced to subspecies.

1902. Robinson and Lyon recorded (p. 142) *sanctæmartæ* as far east as San Julian, near La Guaira, Venezuela.

1903. Bangs described (p. 158) *Sigmodon hispidus furvus*, n. subsp.
1903. Elliot described (p. 144) *Sigmodon hispidus inexoratus*, n. subsp.
1903*a*. J. A. Allen described (p. 99) *Sigmodon puna*, n. sp.
1903*b*. J. A. Allen described (p. 601) *Sigmodon baileyi*, n. sp.
1904. J. A. Allen described (p. 68) *Sigmodon borucæ chiriquensis*, n. subsp.
1906. J. A. Allen described (p. 247) *Sigmodon vulcani*, n. sp.
1908. J. A. Allen described (p. 657) *Sigmodon hispidus griseus*, n. subsp.
1913. J. A. Allen described (p. 479) *Sigmodon chonensis*, n. sp.
1914. Thomas stated that "Burmeister's *Lasiomys hirsutus*, from Maracaibo, is clearly a Sigmodon. . . . "
After reading Burmeister's description I agree with Thomas's opinion.
1921*a*. Thomas described (p. 448) *Sigmodon lönnbergi*, n. sp.
1924. Anthony described (p. 3) *Sigmodon inopinatus*, n. sp.
1923. Goodwin described (p. 1) *Sigmodon zanjonensis*, n. sp.

SIGMOMYS Thomas

1880. Thomas described (p. 691) *Reithrodon alstoni*, n. sp. He was doubtful however whether *alstoni* ought to be placed in *Reithrodon*.
1901. Thomas erected (p. 150) *Sigmomys*, n. g., with type *Reithrodon alstoni* Thomas and described *Sigmomys savannarum*, n. sp.
1904. Ameghino proposed (p. 252) *Sigmomys* for a genus of fossil viscacha (preoccupied by *Sigmomys* Thomas, 1901).
1905. Ameghino corrected (p. 75) his name *Sigmomys*, proposed in 1904, to *Eusigmomys*.
1912. Osgood recorded (p. 54) *Sigmomys alstoni* from the Maracaibo region.
1914. Thomas described (p. 412) *Sigmomys venester*, n. sp. He spoke of "*alstoni* from Cumana."

THE "FISH-EATING" RATS

ICHTHYOMYS Thomas

1891. Winge described (p. 20) *Habrothrix hydrobates*, n. sp.
1893*a*. Thomas erected (p. 337) *Ichthyomys*, n. g., with type (p. 339) *Ichthyomys stolzmanni*, n. sp.
1893*b*. Thomas commented on (p. 286) the newly discovered genus *Ichthyomys*.

1896. De Winton described (p. 507) *Ichthyomys söderströmi*, n. sp.
1897. Thomas described (p. 220) *Ichthyomys trichotis*, n. sp.
1921. Anthony described (p. 1) *Ichthyomys tweedyi*, n. sp.
1923. Anthony described (p. 7) *Ichthyomys orientalis*, n. sp.
1924*a*. Thomas described (p. 165) *Ichthyomys nicefori*, n. sp.
1924*b*. Thomas described (p. 541) *Ichthyomys caurinus*, n. sp.
1929. Anthony compared (p. 3) *Ichthyomys* with *Daptomys*, *Anotomys*, *Rheomys*, and *Neusticomys*.

ANOTOMYS Thomas

1906*b*. Thomas erected (p. 86) *Anotomys*, n. g., to contain *Anotomys leander*, n. sp.
1921. Lönnberg remarked upon (p. 37) *Anotomys leander*.
1929. Anthony compared (p. 3) *Anotomys* with *Daptomys*, *Ichthyomys*, *Rheomys*, and *Neusticomys*.

RHEOMYS Thomas

1906*a*. Thomas erected (p. 421) *Rheomys*, n. g., with type *Rheomys underwoodi*, n. sp.
1912. Goldman described (p. 7) *Rheomys raptor*, n. sp.
1928. Dickey described (p. 11) *Rheomys thomasi*, n. sp., and (p. 12) *Rheomys thomasi stirtoni*, n. subsp.
1929. Anthony compared (p. 3) *Rheomys* with *Daptomys*, *Ichthyomys*, *Anotomys*, and *Neusticomys*.

NEUSTICOMYS Anthony

1921. Anthony erected (p. 2) *Neusticomys*, n. g., with type *Neusticomys monticolus*, n. sp. He compared *Neusticomys* with *Ichthyomys*, *Anotomys*, and *Rheomys* (pp. 4–5).
1929. Anthony compared (p. 3) *Neusticomys* with *Daptomys*, *Ichthyomys*, *Anotomys*, and *Rheomys*.

DAPTOMYS Anthony

1929. Anthony erected (p. 1) *Daptomys*, n. g., with type *Daptomys venezuelæ*, n. sp. He compared (p. 3) *Daptomys* with *Ichthyomys*, *Anotomys*, *Rheomys*, and *Neusticomys*.

PRESENT STATUS OF THE GENERA

Genus *Neotomys* Thomas	Type by monotypy: *Neotomys ebriosus* Thomas
Genus *Sigmodon* Say and Ord (=*Deilemys* de Saussure) (=*Lasiomys* Burmeister)	Type by monotypy: *Sigmodon hispidus* Say and Ord

Genus *Sigmomys* Thomas	Type by original designation: *Reithrodon alstoni* Thomas
Genus *Ichthyomys* Thomas	Type by original designation: *Ichthyomys stolzmanni* Thomas
Genus *Anotomys* Thomas	Type by original designation: *Anotomys leander* Thomas
Genus *Rheomys* Thomas	Type by original designation: *Rheomys underwoodi* Thomas
Genus *Neusticomys* Anthony	Type by original designation: *Neusticomys monticolus* Anthony
Genus *Daptomys* Anthony	Type by original designation: *Daptomys venezuelæ* Anthony

List of Named Forms with Type Localities

Neotomys

ebriosus Thomas	Valley of Vitoc, near Chanchamayo, Peru
vulturnus Thomas	Sierra de Zenta, a range . . . along the eastern edge of Dept. of Tilcara, Jujuy, Argentina, 4500 m.

The Cotton Rats

The cotton rats apparently occur in most relatively open, dry regions from the southern United States to the Rio Branco savannas of north Brazil and as far south along the west coast as Trujillo, Peru. They are represented also in isolated areas at high altitudes.

The smooth-toothed cotton rats (*Sigmodon*) appear to be restricted to the north and west of the Andes (including the Andean highlands). On the other hand, the grooved-toothed species (*Sigmomys*) occupy the savannas of Venezuela, Guyana, and north Brazil, and also pass through the gap in the Caribbean Mountains, at Barcelona to the Caribbean coastal strip, along which they extend westward at least as far as Maracaibo (Osgood, 1912). At Mt. Roraima *Sigmomys* reaches an altitude of 4000 feet. The region between Maracaibo and San Julian, near Puerto Cabello (Robinson and Lyon, 1902), apparently constitutes an area of overlap for these two genera.

Sigmodon

Region 1[1] (north of Costa Rica)

a. Mexico

hispidus toltecus (de Saussure)	Mountains of Vera Cruz, Mexico
hispidus berlandieri Baird	"Between San Antonio and El Paso, in northern Mexico" (By Bailey, 1902, given as Rio Nazas, Coahuilla, Mexico)

[1]For full definitions and map of phytogeographic "regions" of Central and South America see Amer. Mus. Novit., No. 579, 1932, pp. 12–14.

hispidus eremicus Mearns	Cienaga Well, 30 miles south of monument No. 204, Mexican boundary line, on the left bank of the Colorado River, in Sonora, Mexico
hispidus inexoratus Elliot	Ocotlan, Jalisco, Mexico
hispidus tonalensis Bailey	Tonala, Chiapas, Mexico
hispidus major Bailey	Sierra de Choix, 50 miles northeast of Choix, Sinaloa, Mexico
hispidus mascotensis Allen	San Sebastian near Mascota, Mexico
hispidus saturatus Bailey	Teapa, Tabasco, Mexico
hispidus microdon Bailey	Puerto Morelos, Yucatan, Mexico
alleni Bailey	San Sebastian, Mascota, Jalisco, Mexico
melanotis Bailey	Patzcuaro, Michoacan, Mexico, 7000 ft.
leucotis Bailey	Valparaiso Mts., Zacaticas, Mexico, 8700 ft.
alticola alticola Bailey	Cerro San Felipe, Oaxaca, Mexico, 10,000 ft.
alticola amoles Bailey	Piñal de Amoles, Queretaro, Mexico, 7000 ft.
colimæ Allen	Colima, State of Colima, Mexico
fulviventer Allen	Zacatecas, Zacatecas, Mexico
vulcani Allen	Volcan de Fuego, Jalisco, Mexico
baileyi Allen	La Cienaga de las Vacas, northwestern Durango, Mexico, 8500 ft.
b.—Guatemala to Costa Rica	
Guatemala	
zanjonensis Goodwin	Zanjon, on headwaters of R. Negro, about 70 miles northwest of Guatemala City Guatemala, 9000 ft.
Honduras	
hispidus furvus Bangs	Ceiba, coast of Honduras, sea-level
Nicaragua	
hispidus griseus Allen	Chontales, coastal lowlands, Nicaragua
Costa Rica	
hispidus borucæ Allen	Boruca, Costa Rica

Region 2 (north and west of Andes)

Panama	
hispidus chiriquensis Allen	Boqueron, Chiriqui, Panama
austerulus Bangs	Volcan de Chiriqui, Panama, 10,000 ft.
Colombia	
sanctæmartæ Bangs	Pueblo Viejo, Sierra Nevada de Santa Marta, Colombia, 8000 ft.
bogotensis Allen	Plains (east) ? of Bogotá on east bank of Magdalena River
Venezuela	
hirsutus (Burmeister)	Maracaibo, Venezuela

Region 3 (Andes above 6000 ft.)

inopinatus Anthony	Urbina, slopes of Mt. Chimbarazo, Ecuador, 11,400 ft.

Region 4 (arid coastal strip, southern Ecuador to northern Chile)

chonensis Allen	Chone, Manavi, Ecuador
lonnbergi Thomas	Quevedo, lowlands of western Ecuador, due north of Guayaquil
puna Allen	Puna Island, Ecuador
simonsi Allen	Eten, northern Peru
peruanus Allen	Trujillo, Peru
Sigmomys	
alstoni (Thomas)	"Venezuela." (Cumana. Thomas, 1914)
savannarum Thomas	Savannas, at base of Kanuku Mts., British Guiana
venester Thomas	El Trompillo, near Lake Valencia, N. Venezuela, 1300 ft.

THE "FISH-EATING" RATS

Ichthyomys	
hydrobates (Winge)	Sierra de Mérida, Venezuela
soderstromi de Winton	Rio Machangara, near Quito, Ecuador
trichotis Thomas	W. Cundinamarca, low country near R. Magdalena, Colombia
stolzmanni Thomas	Chanchamayo, Peru
tweedyi Anthony	Portovelo, Prov. Oro, Ecuador, 2000 ft.
orientalis Anthony	Near R. Napo, eastern Ecuador, 3000 ft.
nicefori Thomas	Paime, north of Bogotá, Colombia
caurinus Thomas	Below Gualea, northeast of Quito, Ecuador, 2000–3000 ft.
Anotomys	
leander Anthony	Mt. Pichincha, near Quito, Ecuador, 11,500 ft.
Rheomys	
underwoodi Thomas	Tres Rios, Costa Rica
raptor Goldman	Head of Rio Limon, Mt. Pirri, eastern Panama 4500 ft.
thomasi thomasi Dickey	Mt. Cacaguatique, Dept. San Miguel, Salvador, 3500 ft.
thomasi stirtoni Dickey	Los Esesmiles, Dept. Chalatenango, Salvador, 8000 ft.
Neusticomys	
monticolus Anthony	Nono Farm, "San Francisco," near Quito, Ecuador
Daptomys	
venezuelæ Anthony	River Neveri, 15 miles west of Cumanacoa, Prov. Sucre, Venezuela

LIST OF REFERENCES

ALLEN, J. A.

1889. Bull. Amer. Mus. Nat. Hist., II, pp. 165–181.

1891. Bull, Amer. Mus. Nat. Hist., III, pp. 175–194

1897*a*. Bull. Amer. Mus. Nat. Hist., IX, pp. 31–34.

1897*b*. Bull. Amer. Mus. Nat. Hist., IX, pp. 47–58.

1897*c*. Bull. Amer. Mus. Nat. Hist., IX, pp. 115–119.

1897*d*. Bull. Amer. Mus. Nat. Hist., IX, pp. 121–122.

1901. Bull. Amer. Mus. Nat. Hist., XIV, pp. 39–40.

1903*a*. Bull. Amer. Mus. Nat. Hist., XIX, pp. 99–100.

1903*b*. Bull. Amer. Mus. Nat. Hist., XIX, pp. 587–612.

1904. Bull. Amer. Mus. Nat. Hist., XX, pp. 29–80.

1906. Bull. Amer. Mus. Nat. Hist., XXII, pp. 191–262.

1908. Bull. Amer. Mus. Nat. Hist., XXIV, pp. 647–670.

1913. Bull. Amer. Mus. Nat. Hist., XXXII, pp. 469–484.

ALSTON, E. R.

1876. Proc. Zool. Soc. London, pp. 61–98.

1880. 'Biologia Centrali Americana,' p. 152.

AMEGHINO, F.

1904. Anales Soc. Cien. Argentina, LVIII.

1905. Anales Soc. Cien. Argentina, LIX.

ANTHONY, H. E.

1921. Amer. Mus. Novit., No. 20.

1923. Amer. Mus. Novit., No. 55.

1924. Amer. Mus. Novit., No. 114.

1929. Amer. Mus. Novit., No. 383.

BAILEY, V.

1902. Proc. Biol. Soc. Wash., XV, pp. 101–116.

BAIRD, S. F.

1855. Proc. Phil. Ac. Sci., VII, pp. 331–333.

1859. 'Mammals of North America.'

BANGS, O.

1898. Proc. Biol. Soc. Wash., XII, pp. 189–190.

1902. Bull. Mus. Comp. Zoöl., XXXIX, pp. 17–51.

1903. Bull. Mus. Comp. Zoöl., XXXIX, pp. 141–159.

BURMEISTER, H.

1855. Abh. Naturf. Ges. Halle. Sitzungsb., (1854), pp. 15–17.

COUES, E.

1874. Proc. Ac. Sci. Phila., XXVI, pp. 173–196.

1877. 'Monogr. North Amer. Rodentia.' Report Hayden Survey, VI.

Dickey, D. R.	1928.	Proc. Biol. Soc. Wash., XLI, pp. 7–14.
Elliot, D. G.	1903.	Field Mus. Nat. Hist., Zool. Ser., III, pp. 141–149.
Goldman, E. A.	1912.	Smiths. Misc. Coll., LX, No. 2.
Goodwin, G. G.	1932.	Amer. Mus. Novit., No. 528.
Lönnberg, E.	1921.	Arkiv f. Zool., XIV, No. 4, pp. 1–104.
Mearns, E. A.	1897.	Proc. U. S. Nat. Mus., XX, pp. 501–505.
Osgood, W. H.	1912.	Field Mus. Nat. Hist., Zool. Ser., X, pp. 33–36.
Robinson, W., and Lyon, M. W.	1902.	Proc. U. S. Nat. Mus., XXIV, pp. 135–162.
DeSaussure, H.	1860.	Rev. Mag. Zool., Paris, (2) XII, pp. 97–110.
Say, T., and Ord, G.	1824–1825.	Journ. Phila. Ac. Sci., IV, pp. 352–355.
Thomas, O.	1880.	Proc. Zool. Soc. London, pp. 691–696.
	1893*a*.	Proc. Zool. Soc. London, pp. 333–341.
	1893*b*.	Nat. Science, II.
	1894.	Ann. Mag. Nat. Hist., (6) XIV, pp. 346–366.
	1897.	Ann. Mag. Nat. Hist., (6) XX, pp. 218–221.
	1900.	Ann. Mag. Nat. Hist., (7) VI, pp. 294–302.
	1901.	Ann. Mag. Nat. Hist., (7) VIII, pp. 139–154.
	1906*a*.	Ann. Mag. Nat. Hist., (7) XVII, pp. 421–423.
	1906*b*.	Ann. Mag. Nat. Hist., (7) XVII, pp. 86–88.
	1914.	Ann. Mag. Nat. Hist., (8) XIV, pp. 410–414.
	1921*a*.	Ann. Mag. Nat. Hist., (9) VII, pp. 448–450.
	1921*b*.	Ann. Mag. Nat. Hist., (9) VIII, pp. 608–617.
	1924*a*.	Ann. Mag. Nat. Hist., (9) XIII, pp. 164–165.
	1924*b*.	Ann. Mag. Nat. Hist., (9) XIII, pp. 541–542.
	1926.	Ann. Mag. Nat. Hist., (9) XVII, pp. 318–328.
Trouessart, E.-L.	1898.	'Cat. Mamm. viv. foss.'
	1905.	'Cat. Mamm. viv. foss.,' Supplement.
Winge, H.	1887.	E. Mus. Lundii, I, pt. 3.
	1891.	Vid. Medd. nat. Forening, (5) III, pp. 20–27.
DeWinton, W. E.	1896.	Proc. Zool. Soc. London, pp. 507–513.

AMERICAN MUSEUM NOVITATES

Number 584 | Published by The American Museum of Natural History New York City | Nov. 15, 1932

59.88,6 F (85)

STUDIES OF PERUVIAN BIRDS. VIII

THE FORMICARIAN GENERA *CYMBILAIMUS, THAMNISTES, TERENURA, PERCNOSTOLA, FORMICARIUS, CHAMAEZA,* AND *RHEGMATORHINA*

By John T. Zimmer

Cymbilaimus lineatus intermedius (Hartert and Goodson)

Cymbilanius lineatus intermedius Hartert and Goodson, 1917 (December), Novit. Zool., XXIV, No. 3, p. 495—Humaythá, Rio Madeira, Brazil; ♀; Amer. Mus. Nat. Hist. (Tring Coll.).

Twenty-one birds from Perú have been studied in conjunction with a series of one hundred and forty-nine examples from Venezuela, eastern Colombia, eastern Ecuador, the Rio Negro, Brazil, and Brazil south of the Amazon from Teffé to the Tocantins, and with twenty-six skins of *fasciatus* and eight of typical *lineatus*, as shown in the subjoined list of specimens examined.

In spite of this abundant material, the significance of certain observable differences remains obscure. The most constant characteristic shown anywhere is the strong banding of the crown in the males of *lineatus* from Faro, Rio Jamundá, Brazil. With a single male from British Guiana for comparison it is impossible to say whether or not the Faro birds are distinct from typical *lineatus*, but the possibility is suggested.

Birds from Perú and eastern Ecuador are not distinguishable from examples collected on the Rio Madeira. Birds from the Tapajoz are inclined to be a little paler, but Tocantins examples are again darker, and miscellaneous specimens from any of these regions can be matched with individuals from the other places. Males from the upper Rio Negro in Brazil, the vicinity of Mt. Duida, Venezuela, and the Caura Valley are somewhat lighter on average than most of the Ecuadorian and Peruvián birds, but again there is no sharp dividing line. The birds from the Rio Negro, Mt. Duida, and the Caura frequently show as much white barring on the crown as the adult males of *fasciatus* now at hand; those of the *fasciatus* males in the series before me which have pronounced bars on the crown are in every case not fully adult, though others of the same age are no more markedly barred on the head than the fully adult skins. The bill seems to reach its maximum length in *fasciatus*, though it is

often no larger than in *intermedius*, and the dark barring of the underparts may be slightly heavier than in the average of *intermedius*, though that, too, is far from constant.

It appears that males just reaching maturity are more extensively white than old birds; at least, the lightest examples at hand from any locality usually show some traces of juvenal plumage not yet lost in molt. It is logical to assume that a bird might have lost the last trace of its juvenal plumage and thus be of indeterminate age though exhibiting, at the same time, more white in the plumage than its associates. It thus becomes difficult to fix the limits of individual variation among birds of equal age, and the geographical significance of the existing observable differences is largely lost. The darkest birds from the various localities are not so greatly different from each other as are the extremes from each place, and single specimens are of little value for comparisons. Seasonal changes may exist but are not demonstrated in the series examined. The general conclusion reached, however, is that so much variation is present due to age and season, and perhaps to purely individual characteristics, that any rearrangement of forms at present is of doubtful advisability.

In Perú there are records from Iquitos, Pebas, Nauta, Rioja, Huachipa, Monterico, and Cosñipata. The specimens recorded below add nothing to the general outlines of this distributional area which embraces the entire humid tropical region of the country in both upper and lower levels.

SPECIMENS EXAMINED

C. l. lineatus.—BRITISH GUIANA: Tumatumari, 1 ♂, 1 ♀. BRAZIL: Faro, 4 ♂, 2 ♀.

C. l. intermedius.—BRAZIL: Rio Negro, Tatú, 2 ♂, 3 ♀; Mt. Curycuryari, 1 ♀; San Gabriel, 2 ♂, 2 ♀; Yucabi, 3 ♂, 3 ♀; Santa Isabel, 1 ♀; Rio Tocantins, Baião, 2 ♂; Mocajuba, 1 ♂; Rio Xingú, Tapará, 5 ♂, 2 ♀; Porto do Moz, 1 ♂, 2 ♀; Rio Tapajoz, Aramanay, 2 ♂, 3 ♀; Tauary, 1 ♂, 2 ♀; Igarapé Brabo, 4 ♂, 6 ♀; Santarem, 2 ♂, 1 ♀; Mararú, 1 ♂; Boim, 2 ♀; Rio Amazonas, Villa Bella Imperatríz, 7 ♂, 6 ♀; Rio Madeira, Borba, 4 ♂, 3 ♀; Igarapé Auará, 4 ♂, 5 ♀; Rosarinho, 1 ♀; Santo Antonio do Guajará, 1 ♀; Teffé, 1 ♂, 3 ♀; Rio Roosevelt, "Camp 14," 1 ♀; Morinha Lyra, 1 ♂. PERÚ: Astillero, 2 ♂; Río Ucayali, Santa Rosa, 2 ♂; Sarayacu, 2 ♂; Río Amazonas, Orosa, 3 ♂, 5 ♀; Puerto Indiana, 2 ♀; Río Marañón, Pomará, 1 ♂; Río Negro, west of Moyobamba, 3 ♂, 1 ♀; Rioja, 1 ♂[1], 1 ♀[1]; Huachipa, 2 ♀.[1] ECUADOR: mouth of Lagarto Cocha, 3 ♂, 1 ♀; mouth of Río Curaray, 4 ♂, 1 ♀; Río Suno, above Avila, 2 ♂, 2 ♀; lower Río Suno, 3 ♂; below San José, 2 ♂, 1 ♀. COLOMBIA: Florencia, 1 ♀; La Morelia, 1 ♀; Río Uaupés, opposite Tahuapunto (Brazil), 1 ♂, 1 "♀"(= ♂?). VENEZUELA (Río

[1]Specimens in Field Museum of Natural History, Chicago.

Cassiquiare, Río Orinoco, and vicinity of Mt. Duida), 14 ♂, 10 ♀; Río Caura, La Unión, 2 ♂, 1 ♀; Suapure, 1 ♀.

C. l. fasciatus.—NICARAGUA: 7 ♂, 3 ♀. PANAMÁ: 5 ♂, 4 ♀. COLOMBIA: Barbacoas, 4 ♂, 1 ♀; Noanamá, 1 ♀; Nóvita, 1 ♀.

Thamnistes anabatinus rufescens Cabanis

Thamnistes rufescens CABANIS, 1873, Journ. Orn., XXI, p. 65—Monterico (northern Ayacucho), Perú; ♂, ♀; Berlin Mus.

Two females at hand from southeastern Perú differ slightly from each other in the intensity of coloration, as noted previously (Field Mus. Nat. Hist. Publ., Zool. Ser., XVII, p. 325, 1930), for four birds from Huachipa.

Records of this form are from the upper Humid Tropical Zone in southeastern and central Perú, but there is an apparent discontinuity in the three areas which form this range and a hiatus between the northernmost portion (upper Hullaga) and the nearest point in the range of *aequatorialis* to the northward (Sarayacu, eastern Ecuador). These interruptions probably exist only in records and not in nature and may be evident at present only because the species is so rare in collections that its entire range is not known.

Other records are from Amable Maria, La Gloria, and Huaynapata.

SPECIMENS EXAMINED

T. a. anabatinus.—GUATEMALA: 1 ♂.

T. a. saturatus.—NICARAGUA: 4 ♂.

T. a. coronatus.—PANAMÁ: Cituro, 1 ♂.

T. a. intermedius.—COLOMBIA: Barbacoas, 1 ♀ (type); Alto Bonito, 1 ♀. ECUADOR: La Chonta, 1 ♂ (?), 1 ♀; Las Pinas, 1 ♀.

T. a. aequatorialis.—ECUADOR: Río Suno, above Avila, 2 ♂, 1 ♀; below San José, 3 ♂, 4 ♀.

T. a. rufescens.—PERÚ: Río Inambari, 1 ♀; Río Tavara, 1 ♀; Huachipa, 2 ♂[1], 2 ♀.[1]

Terenura callinota (Sclater)

Formicivora callinota SCLATER, 1855, P. Z. S. London, XXIII, p. 89, Pl. XCVI—"Bogotá," Colombia; ♂; British Mus.

A single male from Chaupe furnishes the first definite record of this species from Perú. I have no other males for comparison, but the specimen agrees well with the original description and has the rump chestnut as described but not orange-red as shown in Sclater's plate. It agrees also, except for sexual differences, with two females from Aguadita, Colombia, and a female (not fully adult) from Sabanilla, Ecuador. The

[1]Specimens in Field Museum of Natural History, Chicago.

Colombian skins almost certainly belong to *callinota*, described from "Bogotá," but they also agree well with the description and figure of *T. humeralis* from Sarayacu, Ecuador, except that the superciliary stripe, which is well marked in the figure, is obsolete over the auriculars in the skins.

The ranges of these two forms are not clearly defined and cannot be so until more material has been collected. All the males known from Ecuador belong to *humeralis*, and the only other female recorded from Ecuador, beside the Sabanilla skin, is the female cotype of *humeralis* from Sarayacu. Nevertheless, Sabanilla is possibly in slightly closer geographic affinity to Chaupe, Perú, than to the localities where *humeralis* has been found, and the Sabanilla female, therefore, may be properly assignable to *callinota*, though a male from the same region will be needed to make this allocation certain.

Similarly, the female from Ropaybamba, Perú, described by Taczanowski ('Orn. Pér.,' II, p. 52, 1884) under the name *callinota* but transferred by Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, part 3, p. 203, 1924) to *humeralis*, may really belong to *callinota;* Taczanowski's male from Pebas is described as having chestnut shoulders, and must, therefore, belong to *humeralis*. In the absence of males from the neighborhood of Ropaybamba, the proper identification of the female is impossible. Consequently I am obliged to leave the matter in abeyance and to accept Hellmayr's disposition of the specimen pending future study.

Judging by the apparent similarity in the females and by the exhibition of the same style of difference between the males as is shown in two subspecies of *T. spodioptila*, I am of the opinion that *callinota* and *humeralis* will be found to be conspecies when their relationships are better understood, but I am unwilling to dispose of them in this manner without having seen *humeralis*. Todd's *T. h. transfluvialis* from the Purús appears, from description, to suggest intermediacy with *T. sharpei* of Bolivia and southeastern Perú.

Terenura humeralis Sclater and Salvin

Terenura humeralis Sclater and Salvin, 1880, P. Z. S. London, p. 159—Sarayacu, eastern Ecuador; ♂, ♀; cotypes in British Mus.

As mentioned in the account of *T. callinota*, a male from Pebas, recorded by Taczanowski as *callinota*, belongs to *humeralis*, while a female from Ropaybamba may be the one or may be the other, but must be placed here for the present. There are no other records from Perú.

Terenura sharpei Berlepsch

Terenura sharpei Berlepsch, 1901 (January), Journ. Orn., XLIX, p. 97—Quebrada onda, eastern Yungas, Bolivia; ♂; Frankfort Mus.

Terenura xanthonota Chapman, 1901 (September), Bull. Amer. Mus. Nat. Hist., XIV, p. 328—Inca Mine, Perú; ♂; Amer. Mus. Nat. Hist.

The type of "*xanthonota*" remains the only known Peruvian specimen of this form. Its identity with *sharpei* is not to be questioned without a series from both localities. There is a possibility of relationship to *callinota* and *humeralis* which likewise needs further study. The entire genus awaits future revision when sufficient material may have become available to permit such study. At present all the species are so rare in collections that such revision is impossible.

Examination of the material at hand, however, has resulted in the discovery of an interesting new form of the allied species, *T. spodioptila*, from a region heretofore devoid of records of the genus. This form is to be recognized as follows.

Terenura spodioptila signata, new subspecies

Type from Mt. Curycuryari, Rio Negro (right bank), Brazil; altitude 2000 feet. No. 310,687, American Museum of Natural History. Adult male collected August 18, 1929, by the Olalla brothers.

Diagnosis.—Similar to *T. s. spodioptila* of British Guiana but male with lesser upper wing-coverts chestnut, not gray. Differs from *humeralis* (as described and figured) by having the upper part of mantle almost entirely rufous, not olive-green, the margins of the remiges gray, not green, and the lower under parts pale grayish white, not yellow. The differences separating it from *spodioptila* are the same as those separating *humeralis* from *callinota.* Size apparently smaller than *callinota.* Female apparently with the lower wing-band (on greater coverts) narrower than in *spodioptila;* male with the same character.

Range.—Known only from the type locality.

Description of Type.—Top of head from base of bill to nape black; hind neck slightly brownish black; mantle, scapulars, and lower back Burnt Sienna x Chestnut, with the basal portions of the feathers much paler, but with a narrow brownish gray area between the rufous of the mantle and the black of the hind neck; upper tail-coverts gray with a faint rufous tinge. Lores and a broad superciliary stripe white, the stripe becoming gray posteriorly; a dusky spot in front of the eye and a blackish line behind the eye; malar region and auriculars white; sides of neck, sides of breast, and upper flanks pale gray; rest of under parts slightly grayish white, a little more grayish on the breast; under wing-coverts and axillars pure white. Remiges blackish brown, edged externally with pale gray; greater and median upper wing-coverts blackish brown with white tips forming two wing-bars; these tips on the greater coverts narrow and mostly confined to the outer web, extending slightly basad along the outer margin; tips on median series broader, crossing both webs; lesser coverts mostly rufous like the mantle, only the lowermost row being sooty, with gray tips and a suggestion of rufous which is shown also by the innermost

feathers of the greater and median series; alula and primary-coverts brown with gray outer margins; inner margins of remiges narrowly whitish; tail dark brown with slightly grayish outer margins and inconspicuous pale tips; tail graduated for 5½ mm. Maxilla blackish (in dried skin); mandible paler; feet dull brownish olive. Wing, 48 mm.; tail, 31.25; exposed culmen, 11.12; culmen from base, 14.25; tarsus, 14.25.

REMARKS.—Female with forehead dark Buckthorn Brown; crown darker and duller; upper part of mantle light Buffy Brown; lower part of mantle and uropygium Sanford's Brown x Hazel; upper tail-coverts dull, pale brownish gray; lores buffy whitish; sides of head dull whitish; superciliary stripe obsolete; under parts as in the male but slightly tinged with pale drab on breast and sides; wings as in the male but duller; lesser upper wing-coverts buffy brown; not rufous; tail as in the male but slightly browner, less grayish.

A pair from the western foot of Mt. Duida, Venezuela, a female from the eastern side of the same mountain, and a female from the left bank of the Río Cassiquiare seem to belong to typical *spodioptila* rather than to *signata*. Unfortunately the male is just reaching maturity and the upper wing-coverts are in molt so that it is not possible to be certain of the eventual color of the lesser series. However, the tips of the greater coverts are broader than in the type of *signata* and the scapulars are warm brown with a slight rufous tinge but are not bright rufous, in which respects the bird agrees well with British Guianan males. The females all have broader lower wing-bands than in the paratype of *signata* and agree with *spodioptila* in this respect. Two of the females are decidedly browner above and on the throat than a female from British Guiana and apparently agree with the characters of a female from the Río Caura as recorded by Hellmayr (Field Mus. Nat. Hist. Publ., Zool. Ser., XIII, part 3, p. 203, footnote *b*, 1924), but the female from the eastern side of Mt. Duida is much grayer and less brownish than the other two and is more like the Guianan bird.

Young birds of both sexes have the under wing-coverts yellow or yellowish and the outer margins of the remiges olive-green. The difference from adults is clearly shown by birds from the same localities. This discovery throws some doubt on the validity of *T. s. elaopteryx*, described from French Guiana as having olive-green margins on the remiges. A female from the Rio Jarý, referred to this form by Madame Snethlage, was said to have these margins gray, and another new form, *meridionalis*, from the Tapajoz, was separated from this so-called *elaopteryx* partly because the Tapajoz female had olive-green edges on the remiges.

Four males from Faro now before me should belong to the same form as Madame Snethlage's female from the Jarý. Two are adults and have the margins of the remiges gray. Two are immature, one with full olive margins, the other molting from olive to gray. If the type of *elaopteryx* is fully adult, the Faro and Rio Jarý skins can not be referred to that form, but there is much probability that it is an immature example. The Faro males are slightly purer white on the under parts than typical *spodioptila*, with the breast, in particular, less grayish, and since this is said to be an additional characteristic of *elaopteryx*, I am inclined to accept it in preference to the color of the remigial margins as the true subspecific character, and to call the Faro birds *elaopteryx*.

Two females from the left bank of the Tapajoz must belong to *meridionalis*, if that form is separable, but not all of the characters ascribed to it are observable in these specimens. The type is said to have a grayish breast without any ochraceous tone, but both of the specimens at hand have a distinctly ochraceous tinge on throat and chest. Both birds (like the type) have yellow wing-lining, olive-green margins on the remiges (which are much brighter than in young *spodioptila* and *elaopteryx*), greenish yellow (instead of white) bands on the upper wing-coverts, and a greenish-yellow tinge on the lower abdomen and crissum. One of these birds is not quite adult, judging by a slight looseness of texture in part of the plumage, but the other seems to be quite adult. Possibly *meridionalis* is separable on these characters. The male is still unknown.

SPECIMENS EXAMINED

T. callinota.—COLOMBIA: Aguadita, 2 ♀. ECUADOR: Sabanilla, 1 ♀. PERÚ: Chaupe, 1 ♂.

T. sharpei.—PERÚ: Inca Mine, 1 ♂ (type of *T. xanthonota*).

T. s. spodioptila.—BRITISH GUIANA: Potaro Landing, 1 ♂; Tumatumari, 3 ♂; Rockstone, 1 ♀. VENEZUELA: Foot of Mt. Duida (Río Cunucunumá), 1 ♂, 1 ♀; Mt. Duida, Pie del Cerro (southeastern base), 1 ♀; Solano, Río Cassiquiare, 1 ♀.

T. s. signata.—BRAZIL: Mt. Curycuryari, Rio Negro, 1 ♂ (type), 1 ♀.

T. s. elaopteryx.—BRAZIL: Faro, Rio Jamundá, 4 ♂.

T. s. meridionalis.—BRAZIL: Rio Tapajoz (left bank), Igarapé Amorín, 1 ♀; Igarapé Brabo, 1 ♀.

Percnostola rufifrons minor Pelzeln

Percnostola minor PELZELN, 1868 (September), 'Orn. Bras.,' II, p. 159—S. Izabel (=Santa Isabel, Rio Negro); ♂; Vienna Mus.

The inclusion of this bird as a Peruvian form rests solely on a male collected by Bartlett at Nauta, now in the British Museum.

Hellmayr, who has examined this specimen, notes that it differs

from typical males of *minor* merely by its lighter, nearly slate-gray pileum. The character is somewhat variable in Rio Negro males, some of which have little trace of the grayish margins on the feathers that are broad and conspicuous in other examples. One male from the foot of Mt. Duida (Río Pescada) has so much gray on the head that it suggests the condition described for the Nauta male.

The range of this form is somewhat more extensive than has been shown heretofore. It ranges from the upper Rio Negro northward to the southern slopes of Mt. Duida in Venezuela and westward across the Río Uaupés into extreme eastern Colombia. Incidentally, the material at hand shows also that *P. r. subcristata* crosses the Rio Negro a short distance above Manaos. *P. r. minor* similarly is found on both banks of the upper Rio Negro.

SPECIMENS EXAMINED

P. r. rufifrons.—FRENCH GUIANA: Cayenne, 2 ♂; Tamanoir, 1 ♂; Demerara, 1 ♂. DUTCH GUIANA: Schotelweg, Lelydorp, 1 ♂; Altonaweg, 1 ♀. BRITISH GUIANA: Rockstone, 1 ♂. "GUIANA": 1 ♀. BRAZIL: Obidos, 1 ♂.

P. r. subcristata.—BRAZIL: Faro, 7 ♂, 4 ♀; Manaos, 3 ♂, 2 ♀; Igarapé Cacao Pereira, Rio Negro (right bank), 1 ♂, 1 ♀.

P. r. minor.—BRAZIL: Santa Isabel, Rio Negro, 1 ♂, 1 ♀; Mt. Curycuryari, 1 ♂; Yucabi, 1 ♀; Tatú, 3 ♂; Iauaraté, Rio Uaupés, 1 ♂. COLOMBIA: opposite Tahuapunto, Brazil (Río Uaupés), 2 ♂. VENEZUELA: Mt. Duida, Playa del Río Base, 2 ♂; Campamento del Medio, 3 ♂, 3 ♀; Valle de los Monos, 3 ♂; Río Pescada, 4 ♂, 4 ♀; Lalaja, 1 ♂; Esmeralda, 1 ♂; Río Orinoco, mouth of Río Ocamo, 1 ♀; confluence of Río Huaynía and Río Cassiquiare, 1 ♀; Solano, Río Cassiquiare, 2 ♂, 2 ♀.

Formicarius rufipectus thoracicus Taczanowski and Berlepsch

Formicarius thoracicus TACZANOWSKI AND BERLEPSCH (ex STOLZMANN MS.), 1885, P. Z. S. London, p. 101—Machay, eastern Ecuador; ♂ cotype in Warsaw Mus.; ♀ cotype in Frankfort Mus.

I have no topotypical material nor, indeed, any from eastern Ecuador, but the Peruvian skins at hand agree with the original description and appear to represent the east-Ecuadorian form. Berlepsch and Stolzmann (Ornis, XIII, p. 118, 1906) record three specimens from Huaynapata, southeastern Perú, and Chapman (Bull. Amer. Mus. Nat. Hist., LV, p. 413, 1926) has noted four skins from Chaupe, northern Perú, west of the Río Chinchipe. To these localities I can add Uchco,[1] below

[1]Since commenting on the spelling, "Uschco," for this locality (cf. Amer. Mus. Novitates, No. 500, p. 15, footnote, 1931), I have found "Uchco" used by Osgood and by Dyott, both of whom have visited the locality. Since this is more in accord with the spelling of similar names such as Uchubamba, I believe that it is well to adopt that spelling as the probably correct one.

Almirante, between Chachapoyas and Moyobamba. This locality is on the eastern slopes of the eastern Andes as are also Huaynapata and Chaupe, so the form retains its eastern habitat throughout its range, however interrupted it may appear. Future field work may show its occurrence at yet undetected localities in central-eastern Perú, of which the Uchco record may be the forerunner.

F. r. carrikeri, the Colombian representative of the group, appears to reach western Ecuador in a somewhat modified condition, but the exact significance of the differences is not certain. Except for the type and a male topotype, all the Colombian specimens at hand have the top of the head very dark rufous or even blackish (with slight rufous tendencies), especially on the forehead. The west-Ecuadorian birds, on the other hand, have no trace of this black. The type of *carrikeri* and the other San Antonio bird are like the west-Ecuadorian birds. The problem is to determine whether *carrikeri* is confined to the western Andes in Colombia, extending thence into western Ecuador, while the central and eastern Andes of Colombia support a distinct form with blackish forehead; whether the occurrence of rufous-fronted birds in the west in Colombia is unusual, indicating transition toward *rufipectus* or toward some as yet undescribed Ecuadorian form, while true *carrikeri* should be considered as a dusky-fronted form; or whether a single form inhabits this entire region with variational characteristics. Hellmayr (P. Z. S. London, 1911, p. 1174) records a male and female from the western slopes of the western Andes of Colombia, at Pueblo Rico, of which the male has a full rufous pileum, the female a blackish one. Our series from east of the Río Cauca (mostly from the central Andes but including also one skin from El Roble, on the western slopes of the eastern Andes) is not perfectly uniform since one has the whole top of the head, back to the nape, quite sooty while one or two others have the forehead rufous though of a very deep tone. Much more material is needed and until a larger series is available for study, it is unsafe to do more than state the problem.

Specimens Examined

F. r. rufipectus.—Panamá: Chitrá, 1 ♂, 1 ♀; Tacarcuna, 3 ♂, 1 ♀. Costa Rica: Guayabo, 2 ♂, 1 ♀.

F. r. carrikeri.—Colombia: San Antonio, 2 ♂ (incl. type); La Tigrerra, 1 ♂; Salencio, 1 ♂; La Frijolera, 1 ♂; El Roble, 1 ♀; east of Palmira, 1 ♂, 2 ♀. Ecuador: Salvias, 1 ♂; El Chiral, 1 ♂, 2 ♀; Zaruma, 1 ♂, 1 ♀; vicinity of Gualea, 2 ♂, 1 ♀. Mindo, 2 ♂.

F. m. thoracicus.—Perú: Chaupe, 3 ♂, 1 ♀; Uchco, 1 ♂.

Formicarius colma nigrifrons Gould

Formicarius nigrifrons Gould, 1855, Ann. Mag. Nat. Hist., (2) XV, p. 344—Chamicuros, Perú; British Mus.

Fourteen birds from northeastern Perú are in close agreement with eleven from eastern Ecuador, while five from the left bank of the lower Rio Madeira, Brazil, are referable to the same form, obviously *F. c. nigrifrons*. Other skins from eastern Colombia and the region between the upper Rio Negro and the upper Orinoco, in adjacent parts of Colombia, Brazil, and Venezuela, are somewhat closer to typical *colma* of the Guianas, though intermediate in certain respects between that form and *nigrifrons*.

In the first place, none of the Orinoco-Negro birds are as dark as the best-marked examples of *nigrifrons*, neither as extensively black on the breast nor as blackish at the base of the tail. Furthermore, the adult females of *nigrifrons* from Ecuador and Perú have the throat practically without white except sometimes at the extreme bases of the feathers (sometimes with the entire throat white); in this respect also the Orinoco-Negro females agree with *colma*.

Four skins from the upper Caquetá (Florencia and La Morelia), Colombia, likewise appear to be nearer *colma* than *nigrifrons*.

Among the specimens of *colma* are a number of immature males which are most interesting. One is from British Guiana, one from the Río Caura, Venezuela, one from Esmeralda at the foot of Mt. Duida, one from extreme eastern Colombia on the Uaupés, one from Brazil on the Uaupés, and one from the upper Rio Negro (Santa Maria). These birds all have the forehead rufous like the crown, some without a trace of black (except concealed subterminally) in this area and others with the silky black feathers of the adult plumage beginning to appear among the juvenal rufous ones, showing definitely that the rufous forehead in birds from this region is a character of immaturity. The under parts are in various stages of transition from immature to adult plumage, and one example has the full black anterior under parts of the adult male while the forehead is just beginning to show a trace of black. Included in this group of juvenals, is the specimen from La Union, Río Caura, which was recorded by Cherrie (Bull. Mus. Brookl. Inst. Sci., II, p. 292, 1916) as *Formicarius ruficeps*, and I am convinced that *F. r. orinocensis*, described from the Caura Valley, was based on a similar bird in transitional plumage. The description of *orinocensis* applies perfectly to these specimens, especially to such as have acquired the adult plumage on the under parts. All fully adult birds at hand from the Caura have black foreheads.

With a number of young "*ruficeps*" *amazonicus* for comparison with young *colma*, there is little to observe in the nature of distinguishing characteristics. Possibly the young *amazonicus* have the top of the head paler and the lateral borders of the crown and nape especially so (these features are pronounced in the adults), but the young of the two forms are exceedingly alike. This similarity, taken in conjunction with the ease of confusion between the adults of *ruficeps* and *amazonicus* and the young of *colma*, and considering the geographic replacement of the various forms, points to the conspecific affinity of *colma* and *ruficeps,* and I have so considered the group.

Incidentally, it may be emphasized that Daubenton's plates (Pl. Enl. 703, fig. 1, and 821) on which the name *colma* and the synonyms *cayanensis* and *tetema* are based, figure rufous-fronted birds like the specimens under discussion, a fact which led Sclater ('Cat. Birds Brit. Mus.,' XV, p. 302, 1890) to consider these names as applicable to the form described by Spix under the name *ruficeps.*

The young of *nigrifrons* are usually separable from those of *colma* and *amazonicus* by their sootier breasts and darker crowns. Not only is the tone of rufous on the head duller and darker but there is a central area in which the rufous tips are even more obscure and sometimes quite absent, leaving a sooty coronal patch. In a young male from the left bank of the Rio Madeira, the forehead also is blackish, but in the other young birds it is rufous as in young *colma.*

The bird described by Wied ('Beitr. Naturg. Bras.,' III, (2), pp. 1038, 1841, in text) as the nestling of "*Myioturdus tetema*" (=*Formicarius c. ruficeps*) is at hand and is in juvenal plumage but has the remiges and rectrices in molt, and such of these as are sufficiently developed to be examined are of a pattern totally unlike that of any *Formicarius.* The remiges are narrowly margined with white on the inner webs and with indications of whitish edges externally on the primaries; the alula has a white outer margin; the upper wing-coverts are broadly tipped with deep buff; the outer rectrices are barred with white and blackish brown; the whole upper parts of head and body are Bister with Cinnamon tips; the under parts are soiled whitish or buffy white with narrow brown subterminal bars. Unfortunately the bill is completely missing. The pattern, however, is shown rather exactly by the remains of male juvenal plumage in certain subadult specimens of *Taraba major major* from Argentina and Matto Grosso and I have no doubt that Wied's bird belongs to that species (subspecies indeterminable). I am unable to match it with any other Formicarian. The large feet (tarsus, 27 mm.) narrow the search considerably.

The range of *F. c. nigrifrons* in Perú is restricted to the lower Tropical Zone. There are no records from north of the Amazon in Perú although the bird occurs on the lower Napo in Ecuador and should reach the north bank of the Marañón. The greatest southward extension of range is along the Ucayali where it reaches at least to the mouth of the Urubamba. Records not listed below are from Chamicuros, Yurimaguas, and Chuchurras.

SPECIMENS EXAMINED

F. c. colma.—FRENCH GUIANA: Cayenne, 1 ♂, 1 (?); Tamanoir, 1 ♂; Pied Saut, 2 ♀. BRITISH GUIANA: Kamakusa, 1 (?); Potaro Landing, 1♂; Tumatumari, 1 ♂; "British Guiana," 1 ♂, 1 ? (type of *F. glaucopectus* Ridgway). VENEZUELA: La Unión, Río Caura, 1 ♂, 3 ♀; El Llagual, 1 ♂; foot of Mr. Duida (=Río Cunucunumá), 2 ♀; Playa del Río Base, 2 ♂; Valle de los Monos, 1 ♀; Caño León, 1 ♀; "Primer Campamento," 1 ♂; Esmeralda, 5 ♂, 1 ♀; Río Orinoco, mouth of Río Ocamo, 3 ♀; opposite mouth of Ocamo, 2 ♂, 1 ♀; Río Cassiquiare, El Merey, 2 ♀; opposite El Merey, 4 ♂, 1 ♀. COLOMBIA: Río Uaupés, opposite Tahuapunto, 1 ♂; Florencia, Río Caquetá, 1 ♂; La Morelia, 3 ♂. BRAZIL: Rio Uaupés, Tahuapunto, 1 ♂; Rio Negro, Tabocal, 1 ♂; Santa Maria, 1 ♂; San Gabriel, 1 ♀; Manaos, 2 ♀; Faro, 7 ♂, 2 ♀.

F. c. nigrifrons.—ECUADOR: Río Suno, above Avila, 1 ♂, 1 ♀; lower Río Suno, 2 ♂, 3 ♀; below San José, 1 ♂, 1 ♀; mouth of Lagarto Cocha, 2 ♂. PERÚ: Orosa, Río Amazonas, 2 ♀; Sarayacu, Río Ucayali, 3 ♂, 1 ♀; Santa Rosa, upper Ucayali, 2 ♂, 1 ♀; Lagarto, 2 ♂, 1 ♀; mouth of Río Urubamba, 2 ♂. BRAZIL: Rio Madeira (left bank), Rosarinho, 2 ♂; Santo Antonio de Guajará, 1 ♂, 2 ♀.

F. c. amazonicus.—BRAZIL: Rio Madeira (right bank), Borba, 2 ♂, 2 ♀; Rio Roosevelt, Broken Canoe Rapids, 1 ♀; Rio Amazonas, Villa Bella Imperatríz, 8 ♂, 4 ♀; Rio Tapajoz, Pinhel, 1 ♂; Igarapé Amorín, 2 ♂; Limoãl, 2 ♂, 1 ♀; Igarapé Brabo, 3 ♂, 3 ♀; Tauary, 1 ♂; Piquiatuba, 1 ♂; Caxiricatuba, 2 ♂, 1 ♀, 1 (?); Rio Tocantins, Baião, 1 ♂, 1 ♀; Arumatheua, 1 ♀; Kelvú, Maranhão, 2 ♂, 1 ♀.

F. c. ruficeps.—BRAZIL: "Bahia," 2 (?); Jaguaquara, Bahia, 1 ?; Lagôa do Forno, Rio Grande do Sul, 1 ♀; Salto Pirahy, Santa Catharina, 1 ♀.

NOTE

Formicarius analis has been discussed in No. 1 of the present series of papers, Amer. Mus. Novitates, No. 500, pp. 20–22, 1931.

Chamaeza brevicauda punctigula Chapman

Chamaeza columbiana punctigula CHAPMAN, 1924, Amer. Mus. Novitates, No. 123, p. 4—Río Suno, above Avila, Tropical Zone, eastern Ecuador; ♂; Amer. Mus. Nat. Hist.

The discovery of the Ecuadorian subspecies of *brevicauda* on the Río Chinchipe, Perú, is not surprising, especially since it was already

known to occur as far to the southwest in Ecuador as Sabanilla, Province of Loja.

The Peruvian bird is slightly paler above than Río Suno and San José specimens but is more worn and probably more faded, having been collected in September, whereas the east-Ecuadorian examples were taken in February and April. The Sabanilla bird, secured in November, is also somewhat worn and faded though less so than the Peruvian skin.

There is some variation in the prominence of the blackish subterminal band on the tail. This band is weak in a San José female and is absent from the median rectrices in the Peruvian skin, also a female. Similar variation occurs in other subspecies of the group. In any case the Río Chinchipe skin appears to be inseparable from *punctigula.*

Chamaeza brevicauda olivacea Tschudi

Ch(amaeza) olivacea Tschudi, 1844 (May), Arch. Naturg., X, (1), p. 279—Perú (Montaña de Vitoc, Dept. Junín suggested by Hellmayr, 1924); Mus. Neuchâtel.

I have not seen this form. It appears to be confined to the Chanchamayo Valley in central Perú, and, outside of Tschudi's birds, has been collected at La Gloria, La Esperanza, and Masayacu.

The various subspecies of *brevicauda* are all quite isolated so far as recorded specimens demonstrate the distribution. Probably the difficulty of collecting them accounts for much of their rarity in collections. Future intensive field work may narrow some of the present gaps in the known ranges. There is no apparent reason why *olivacea* or a related form should not be found along the eastern Andes between the Huallaga and the Marañón, but there are no records from this entire region. Across the Marañón, on the Chinchipe, *C. b. punctigula* takes its place, while to the southeastward, *C. b. berlepschi* completes the roster of Peruvian forms. The latter form is discussed below.

Chamaeza brevicauda berlepschi Stolzmann[1]

Chamaeza brevicauda berlepschi Stolzmann, 1926 (December 31), Ann. Zool. Mus. Pol. Hist. Nat., V, (4), p. 216—Huaynapata, Marcapata Valley, southeastern Perú; ♀; Warsaw Mus.

In 1906 (Ornis, XIII, p. 118), Berlepsch and Stolzmann noted certain characteristics of a female *Chamaeza* from Huaynapata (one of

[1]The late Jan Stanislas Sztolcman, Polish naturalist, published his writings under this name as well as under the variant, "Jean Stolzmann." It was under the latter spelling that his earlier contributions to Peruvian ornithology were made public and by this name that his contemporary, Taczanowski, made voluminous references to his Peruvian records. I have decided, therefore, to use this spelling uniformly throughout the present Peruvian studies, regardless of the particular style adopted by the author in question in individual cases. In the bibliography of Peruvian ornithology, to be incorporated in the final volume of the work in hand, more details will be given for the various titles.

three skins obtained by Kalinowski, two of which had been distributed elsewhere). Twenty years later, Stolzmann named the form *berlepschi* from the same specimen. Hellmayr and Seilern meanwhile (Arch. Naturg., LXXVIII, A, 5, p. 131, 1912) had described *C. b. boliviana* from Quebrada Onda, Bolivia. From the descriptions, however, *berlepschi* is not exactly intermediate in coloration between *olivacea* and *boliviana,* both of which are said to be olivaceous above while *berlepschi* is more rufescent than either of the others. In other respects, the resemblance appears to be closer to *bolivianus* than to *olivacea,* as might be expected in view of the geography of the regions in question.

Without a series of specimens from southeastern Perú and Bolivia, it is impossible to pass judgment on the validity of *berlepschi,* but the characters given for it are sufficient to maintain the form if they are constant, since they are of the same sort as those which separate other subspecies of the group.

The range of *berlepschi* may, therefore, be given as restricted to the Marcapata Valley, southeastern Perú, pending the advent of additional specimens. There are no recorded specimens other than the three collected by Kalinowski.

Chamaeza brevicauda columbiana Berlepsch and Stolzmann

Ch(amaeza) columbiana Berlepsch and Stolzmann, 1896, P. Z. S. London, p. 385—"Bogotá"; Frankfort Mus.

Although not a Peruvian form, this subspecies presents certain problems which it may be of interest to state here in the hope that future investigations may help in their solution.

The form was described from "Bogotá" skins, the exact locality of which, of course, is uncertain. The characters were not given by direct description but, instead, certain specimens of *olivacea* from Perú were discussed in comparison to the "Bogotá" birds which were then given the name *columbiana.* Judging by this comparison, *columbiana* has a white throat and belly, non-olive sides and non-ochraceous flanks, broader blackish margins on the feathers of belly and flanks, olive-brown upper parts, a well-marked superciliary stripe and a well-marked subterminal band on all rectrices. Later authors have noted the upper parts of "Bogotá" skins as Mars brown or russet brown, though the tail is said to lack the blackish band on the median rectrices, noted as present in the original skins.

A single "Bogotá" skin at hand is, indeed, quite rufescent brown on the upper parts, and the median rectrices have the dark subterminal band

poorly developed though not entirely absent, but this bird is immature and not reliable for purposes of subspecific comparison. On the other hand, our skins from Buena Vista, a short distance below Bogotá on the eastern slopes of the Andes, are not at all rufescent above but are quite olivaceous, though not so greenish as typical *brevicauda*. The question arises as to what these Buena Vista birds may be.

C. b. venezuelana, described from Caracas, Venezuela, has been recorded from San Cristóbal, Tachira, not far from the Colombian border though some distance away from Buena Vista. This form, which I have not seen, is said to be olivaceous above, comparable to *brevicauda*. The Buena Vista specimens may possibly be referable to this form, though they are far less greenish olive than *brevicauda*, as I have mentioned above. On the other hand, the existing "Bogotá" skins may be somewhat discolored from postmortem change, and the fresher Buena Vista specimens may show the true coloration of *columbiana*. The difficulty lies in finding a range for *columbiana* distinct from the eastern slope of the eastern Andes where Buena Vista is situated. Collectors in other localities adjacent to Bogotá have failed to find any representatives of this group.

Consequently, with both range and taxonomic characters of *columbiana* in doubt, the reference of the Buena Vista skins to that form is justified only by the geographic position of the locality with reference to Bogotá and is subject to revision.

Specimens Examined

C. b. fulvescens.—British Guiana: Merumé Mts., 1 ♂ (cotype).[1]

C. b. columbiana.—Colombia: "Bogotá," 1 (?) imm.; Buena Vista, 1 ♂, 3 ♀.

C. b. punctigula.—Ecuador: Río Suno, above Avila, 2 ♂ (incl. type), 1 ♀; below San José, 2 ♂, 1 ♀; Sabanilla, 1 ♂. Perú: Huarandosa, Río Chinchipe, 1 ♀.

C. b. brevicauda.—Brazil: Itapura, São Paulo, 1 ♀; "Brazil," 1 ♂. Argentina: Misiones, 1 ♂; Santa Ana, Misiones, 1 (?).

Chamaeza nobilis nobilis Gould

Chamaeza nobilis Gould, 1855 (May), Ann. Mag. Nat. Hist., (2) XV, p. 344—Chamicurros (=Chamicuros), Perú; a cotype in British Mus. and one in Acad. Nat. Sci. Philadelphia.

The typical form of the species was described from Chamicuros, on the eastern side of the Huallaga, and has since been recorded from Santa Maria, on the lower Ucayali. According to the material at hand, it

[1]Salvin and Godman, in the original description of this form, said that there were six skins of it in Whitely's collection. Since no single specimen was selected as type, the original six birds must be considered as cotypes, of which the present specimen is one.

extends up the Ucayali to the mouth of the Urubamba and also eastward, though the latter extension was assured by Todd's record of the species from the Purús in Brazil.

The birds from Orosa and the Ucayali are all characterized by an olivaceous tone of the upper surface which is lacking in specimens from north of the Amazon in Perú, Ecuador, and Colombia. These northern birds are distinctly darker and more rufescent above, and although an occasional skin from south of the river approaches their ruddy tone, almost all of them are readily distinguishable and some of them are extremely marked. Since this form has not been named, I describe it hereunder.

Regarding the types of *nobilis*, Gould says nothing concerning the number of examples which he had, though he remarks that the specimens from which his descriptions of various new forms (described in the paper in question) were drawn were in his own collection. There appear to be two examples of *nobilis* from Gould's collection labeled by Gould as "type," one in the British Museum and one in the Academy of Natural Sciences of Philadelphia. In the absence of any specification by Gould, both of these specimens must be accorded equal rank as cotypes.

Chamaeza nobilis rubida, new subspecies

Type from the lower Río Suno (mouth of the Río Huataraco), eastern Ecuador. No. 184,388, American Museum of Natural History. Adult male collected March 11, 1924, by Carlos Olalla and sons.

Diagnosis.—Similar to *C. n. nobilis* of northeastern Perú, south of the Marañón, but upper parts darker and more rufescent in tone, especially on the neck and upper tail-coverts; under tail-coverts averaging more buffy and more heavily margined with blackish; size averaging slightly smaller.

Range.—Eastern Perú, north of the Marañón, eastern Ecuador, and southeastern Colombia.

Description of Type.—Top of the head from crown to nape deep Argus Brown x Auburn, with centers of feathers more sooty; forehead black; hind neck and sides of neck bright Hazel x Argus Brown, with a concealed whitish stripe along the sides of the neck from the lower border of the auriculars posteriad; back Argus Brown x Brussels Brown with ill-defined, dusky, subterminal bars; upper tail-coverts again brighter, like the hind neck. Lores whitish on lower portion, light chestnut on upper portion adjacent to the black forehead; a rufous-brown spot before the eye continued on the upper eyelid back to the middle of the orbit; posterior half of upper eyelid white, continued more broadly (somewhat tinged with ochraceous), over the auriculars; auriculars, subocular space, and upper border of malar region like the back, merging into the color of the sides of the neck; lower portion of malar region white with a fine triangular, blackish brown spot at the tip of each feather and a dusky outer margin on the outermost series, forming a blackish line between the white and the brown portions of this area; chin white with a similar blackish lateral border;

throat white with sparse, dusky brown dots anteriorly and larger ones below which expand on the lowermost feathers into terminal lunules. Breast heavily marked with broad, blackish lateral and terminal borders on each feather bounding a sagittate white center sometimes buffy at tip; these dark margins become broader away from the middle line of the breast until the whitish center is reduced to a shaft streak; on the sides of the breast the black borders disappear or are reduced to a terminal margin, the white stripe becomes obsolete, and the general color becomes brown, first on outer webs and then on both webs, merging into the color of the back; on the lower breast, the dark margins are again narrowed and interrupted at the shaft by the white centers reaching the tips of the feathers; flank feathers similarly white to the tips but blackish borders broad, and on the outermost feathers the white stripe is withdrawn from the inner web, being retained only on the outer web. Belly white with reduced dusky margins on upper portion, pure white on the lower portion; feathers of femoral tracts whitish or dull buffy, with dull sooty lateral margins and a short, longitudinal, sooty shaft-stripe (sometimes a subterminal, oblique bar) which is absent on some of the feathers; tibial feathers dull grayish brown with narrow, dull ochraceous tips on outer side, broad white tips on inner side; under tail-coverts pale buff, with dark brown margins, lateral row with the dark outer border moved inward toward the shaft and the outer portion of outer web brighter brown; tips of longest coverts uniform buff. Remiges blackish brown, with outer margins of secondaries and exposed portions of tertials and upper wing-coverts slightly darker than the back. Under wing-coverts largely white, with broad brownish tips, darker on the primary series; marginal coverts deep brown with whitish shaft-stripes near wrist. Tail dark Bister, with a broad blackish subterminal band, wider and less clearly defined on outer remiges; a narrow terminal band of brownish gray on middle pair, wider and white instead of gray on the remainder though an outer border of gray is retained which is progressively narrower toward the outermost pair; the white area is divided or partly divided by a lanceolate projection of the black subterminal border along the shaft posteriad; tips of rectrices laterally rounded but with a short, acute projection at the shaft. Bill black, with the lower border of mandible yellowish (in dried skin); feet dark brown. Wing, 114.5 mm.; tail, 59; exposed culmen, 20; culmen from base, 26; tarsus, 41.

REMARKS.—Females averaging slightly smaller than the males; pattern and color similar but averaging more rufescent, with the hind neck sometimes dark Hazel x Sanford's Brown and the other colors correspondingly warmer.

Individual variation of both sexes shows the tail-bands sometimes less pronounced than in the type, sometimes more sharply defined; gray tip of median rectrices sometimes with a white shaft-streak; under tail-coverts sometimes more purely whitish and sometimes less heavily margined; sides of breast sometimes brighter brown. Wings (♂), 108–114.5 mm.; (♀), 105–113; tail (♂), 58–60; (♀), 55–63; culmen from base (♂), 24–26; (♀), 24–26; tarsus (♂), 40–43; (♀), 39–41.25. Corresponding measurements in *C. n. nobilis* show the wings (♂), 108.5–116.5; (♀), 107–110; tail (♂), 61–66.5; (♀), 56–63; culmen from base (♂), 23–28; (♀), 25.5–26.25; tarsus (♂), 40–42.5; (♀), 40–41.

Taczanowski's description of "*nobilis*" ('Orn. Pér.,' II, p. 79, 1884) was drawn up from a specimen taken at Sarayacu, Ecuador, which, from both locality and description, must belong to *rubida*. Todd's *C. n. fulvipectus* from the Rio Tapajoz, Brazil, I have not seen.

SPECIMENS EXAMINED

C. n. nobilis.—PERÚ: Orosa, 4 ♂, 3 ♀; Sarayacu, Río Ucayali, 1 ♂; mouth of Río Urubamba, 2 ♂.

C. n. rubida.—PERÚ: Apayacu (=Anayacu), 1 ♀. ECUADOR: Río Suno, above Avila, 1 ♂, 2 ♀; lower Río Suno, 4 ♂ (incl. type), 4 ♀; mouth of Lagarto Cocha, 1 ♀; mouth of Río Curaray, 2 ♂, 3 ♀. COLOMBIA: La Morelia, 1 ♂, 2 ♀.

Rhegmatorhina melanosticta brunneiceps Chapman

Rhegmatorhina brunneiceps CHAPMAN, 1928, Amer. Mus. Novitates, No. 332, p. 9—Río Seco, about 30 miles west of Moyobamba, Perú; ♂; Amer. Mus. Nat. Hist.

Although this form is quite well marked, its characteristics are only those of *melanosticta* somewhat exaggerated and do not seem to be of full specific value. I see no reason, therefore, for keeping *brunneiceps* out of a place in the *melanosticta* group where it occupies a natural and otherwise unoccupied corner of the range of the species.

I believe that the species is closer to the genus *Rhegmatorhina* than to *Gymnopithys* where it was placed provisionally by Hellmayr (1924). Although the structure of the feathers on the top of the head is different from that exhibited by either *Gymnopithys* or *Rhegmatorhina* as usually restricted, it is the only important character which diverges from *Rhegmatorhina* while there are other additional features which distinguish *Gymnopithys*. As suggested by Hellmayr, a separate genus could be created for this species alone, but I do not believe that the differences are sufficient to warrant such a course, the extreme result of which would be monotypic genera for all good species.

Rhegmatorhina melanosticta badia, new subspecies

TYPE from La Pampa, southeastern Perú (Tropical Zone). No. 146,144, American Museum of Natural History. Adult male collected October 15, 1916, by Harry Watkins; original number 299.

DIAGNOSIS.—Similar to *R. m. melanosticta* from eastern Ecuador but decidedly more rufescent brown on body, wings, and tail, which are only a little less brightly rufescent than in *brunneiceps;* head about as in *melanosticta*, possibly grayer and less brownish above.

RANGE.—Tropical Zone of southeastern Perú.

DESCRIPTION OF TYPE.—Narrow circumocular space denuded, except for blackish feathering on eyelids; surrounding this space a wider ring of brownish-black

feathers, those above the eye somewhat stiffened, short, pointed, and semi-erect and with their bases rufescent; whole top of head from anterior part of lores to hind neck soiled buffy white at bases of feathers, sooty brown at tips, the feathers being long, stiffened, and semi-decomposed; back Argus Brown with a tinge of Auburn, and with the shafts inconspicuously dusky, occasionally developing a blackish subterminal spot on some of the feathers. Malar region and auriculars brownish black, included in the circumocular ring; sides of neck brownish olive with traces of dusky subterminal spots; breast, sides, and most of belly Raw Umber x Brussels Brown; flanks more rufescent (Brussels Brown x Argus Brown); under tail-coverts like flanks but with dusky subterminal spots and buffy tips, not very conspicuous; upper tail-coverts brighter rufous than the back; tail fuscous but outer margins and most of middle rectrices rufescent like the back, tips darker. Wings above fuscous, but exposed outer surfaces bright Auburn; upper wing-coverts slightly brighter than the back, the lesser and middle series with small, blackish, subtermnial spots which are only faintly suggested on the greater series; under wing-coverts like breast; under side of remiges largely Cinnamon-Rufous, grayish brown at tips; maxilla grayish black (in dried skin); mandible dull whitish; feet black. Wing, 85.25 mm.; tail, 50.5; exposed culmen, 17; culmen from base, 20; tarsus, 28.5.

REMARKS.—The second male at hand is browner on the head than the type but a little less rufescent on the back and is without most of the blackish dots on the upper wing-coverts; the under side is a little brighter than in the type.

Dr. Chapman (Bull. Amer. Mus. Nat. Hist., LV, p. 402, 1926) called attention to the more rufous coloration of one of the La Pampa birds as compared with a single Ecuadorian skin of *melanosticta*. The acquisition of a female from Ecuador and another male from La Pampa has shown the difference to be apparently of subspecific value. The young male recorded by Hellmayr from San Gaban should belong to the new form. Judging by its description it has the top of the head sootier than in either of the skins before me.

Rhegmatorhina melanosticta purusiana (Snethlage)

Gymnopithys purusiana SNETHLAGE, 1908, Bol. Mus. Goeldi, V, No. 1, p. 59—Cachoeira, Rio Purús, Brazil; ♂; Mus. Goeldi.

A female, not quite adult, from the mouth of the Río Urubamba, Perú, must be referred to *purusiana* and not to the other subspecies known from Perú. It agrees very well with skins from Teffé and the left bank of the lower Rio Madeira, Brazil, which I assume to represent *purusiana;* though they are not topotypical, they come from both east and west of the type locality. The Teffé male is somewhat darker than the Rosarinho males. The females exhibit much variation in the size of the dorsal spots; these are smallest in the adult Teffé female but are as large in the Peruvian bird as in any of the Rosarinho skins. The Madeira

birds are very slightly grayer on the under parts, the Teffé and Lagarto birds slightly browner. The eastern birds of both sexes also have the crown slightly clearer whitish basally. These differences are very slight and may be interpreted as a tendency in the west toward *badia* or *melanosticta* without exceeding the limits of *purusiana*.

Specimens Examined

R. m. melanosticta.—Ecuador: Río Suno, above Avila, 1 ♂; mouth of Lagarto Cocha, 1 ♀.

R. m. brunneiceps.—Perú: Río Seco, west of Moyobamba, 2 ♂ (incl. type), 2 ♀.

R. m. badia.—Perú: La Pampa, 2 ♂.

R. m. purusiana.—Perú: mouth of Río Urubamba, 1 ♀. Brazil: Teffé, 1 ♂, 2 ♀; Rosarinho, Rio Madeira, 2 ♂, 5 ♀; Santo Antonio de Guajará, 1 ♂.

AMERICAN MUSEUM NOVITATES

Number 585 | Published by The American Museum of Natural History New York City | Nov. 15, 1932

56.9,61 T (1182:58 8)

TRILOPHODON COOPERI, SP. NOV., OF DERA BUGTI, BALUCHISTAN[1]

By Henry Fairfield Osborn

Forster Cooper described as '*Bunolophodon angustidens*' in his paper of 1922 on the "Miocene Proboscidia from Baluchistan" (pp. 610–620, figs. 1–7)[2] a younger palate (Brit. Mus. M12178), an older palate (Brit. Mus. M12179), and right and left fragments of a lower jaw (Brit. Mus. M12181).

The latter specimen (Fig. 1) is selected by the present writer as the *type* of a new primitive species, because of the possession of a perfectly preserved third right inferior molar (*op. cit.*, p. 614, "Lower jaw with third molar in the alveolus." As paratypes are selected: (1) The younger palate (Brit. Mus. M12178) "with second molars just erupting" (*op. cit.*, fig. 1, p. 611), and (2) the older palate (Brit. Mus. M12179) containing Dp^4-M^2, second molar with two anterior ridge-crests partly worn (Fig. 2).

The registered numbers of the jaw and palates, kindly furnished by Mr. Arthur T. Hopwood of the British Museum (June 22, 1932), are as follows:

Trilophodon cooperi

Osborn's type: Right ramus, Brit. Mus. M12181 (Cooper, 1922, fig. 2); cast Amer. Mus. 5205

Osborn's paratypes:

Older palate, Brit. Mus. M12179; cast Amer. Mus. 5211

Younger palate, Brit. Mus. M12178 (Cooper, 1922, fig. 1)

The type and paratype figures of Cooper and Osborn are as follows:

Type jaw: Figure 2 of Cooper (1922), figure 1 of Osborn

Paratype, older palate: Figure 2 of Osborn

Paratype, younger palate: Figure 1 of Cooper (1922), not figured in the present article

It gives the present writer great pleasure to dedicate this very important and geologically ancient new species to his friend C. Forster Cooper, in recognition of his valuable services to mammalian palæontology, especially his two expeditions to the Lower Miocene deposits of Dera Bugti, Baluchistan.

[1]This is the author's thirtieth communication on the evolution and classification of the Proboscidea since 1918, and the fortieth in his total list of papers on the Proboscidea since 1907. See the author's chronologic and classified Bibliography in his "Fifty-two Years of Research, Observation and Publication 1877–1929," published in 1930.

[2]Cooper, C. Forster, "Miocene Proboscidia from Baluchistan." Proc. Zool. Soc. London, Pt. III, September, 1922, pp. 609–626, Pls. I–IV, text figs. 1–12.

Cooper in his very detailed description and figures of these Dera Bugti mastodonts, and after comparison with Cuvier's '*Mastodon angustidens*' and Schlesinger's '*M subtapiroidea,*' referred the specimens listed above to '*Bunolophodon angustidens*' He concluded (*op cit*, p 610) "This is consonant with the view, supported by other reasons, that the stage of *angustidens* represented by these Indian forms is earlier than that of the more typical French forms from Sansan, etc, and is possibly as early as any yet described"

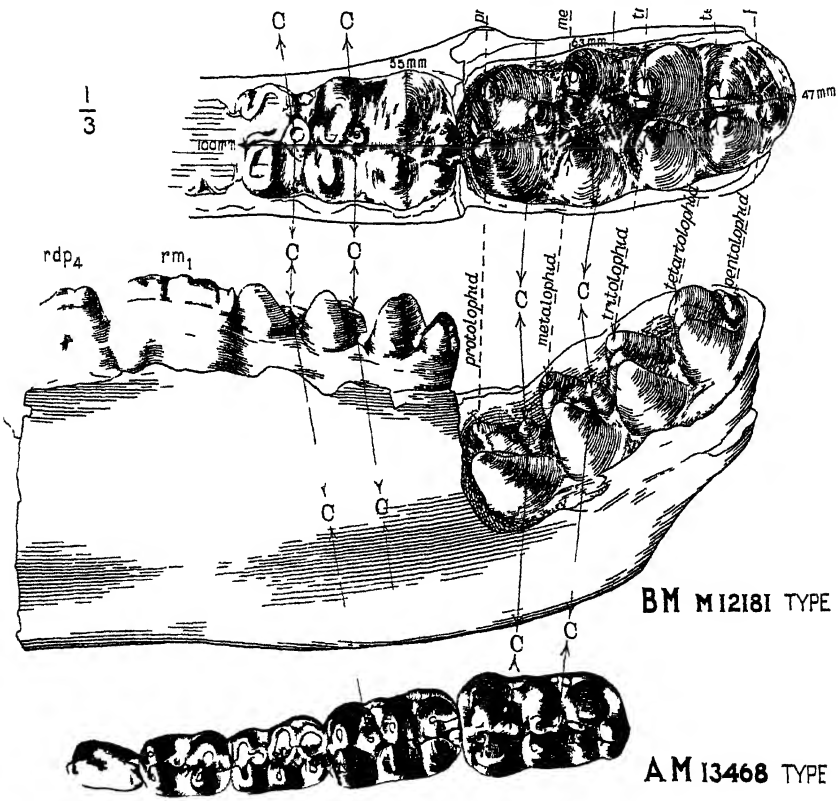


Fig 1 Type mandible of *Trilophodon cooperi* Osborn (Brit Mus M12181, cast Amer Mus 5205) in comparison with the type of *Phiomia osborni* (Amer Mus 13468) One-third natural size Conspicuous central conules (*C C*) present

New and very close comparison with Cuvier's type of *Mastodon angustidens*, with Lydekker's type of *M angustidens palæindicus*, with Osborn's holotype of *Trilophodon chinjiensis*, and with Pilgrim's type

of *Trilophodon macrognathus,* confirms Forster Cooper's opinion and demonstrates beyond question that the type of *Trilophodon cooperi* represents an extremely primitive stage in the evolution of the highly characteristic inferior molars of *Trilophodon;* this stage is the next higher known above *Phiomia osborni* (see Osborn's forthcoming Memoir). The type and paratype grinding teeth may be characterized in the following specific definition

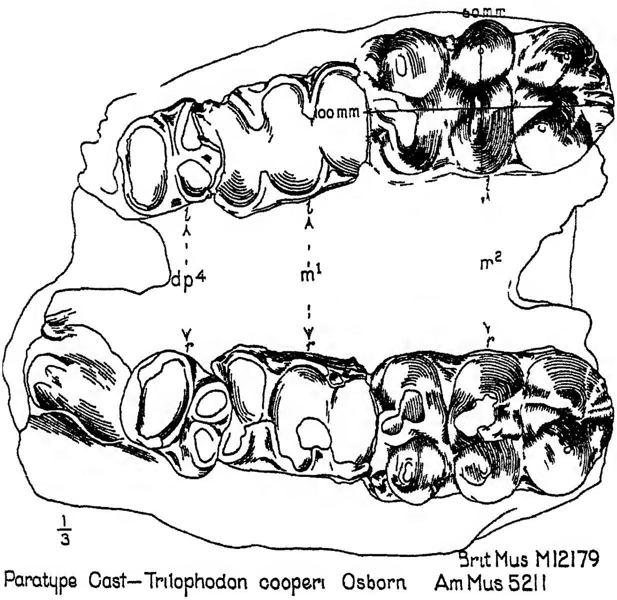


Fig. 2. *Trilophodon cooperi* paratype, 'older palate' (Brit. Mus. M12179, cast Amer. Mus. 5211) containing Dp^4-M^2; second molar with two anterior ridge-crests partly worn. One-third natural size. Central conules absent.

Trilophodon cooperi, sp. nov.

Inferior Molars.—Third inferior molars relatively long and narrow (ap. 147 mm., tr. 63 mm., index 43); with 4½ ridge-crests, relatively obtuse in lateral aspect; internal and external cones subdivided into two conelets; central conules (*C C*) in first and second valleys only. Second inferior molars relatively long and narrow (ap. 100 mm., tr. 55 mm., index 55), as in *Phiomia osborni;* with 3 obtuse ridge-crests.

Superior Molars.—Second superior molars relatively broad (ap. 100 mm., tr. 60 mm., index 60); with 3 ridge-crests; no central conules; internal cones subdivided into two conelets; external cones single not subdivided.

The significance of the above specific definition becomes more clear in the type figure (Fig. 1) and in a new synthetic diagram, for the

Memoir, which altogether has occupied several months in preparation and analysis of *Trilophodon* molar evolution, as follows:

THIRD INFERIOR MOLARS.—The 'ascending mutations' and species of the *Phiomia-Trilophodon* phylum invariably exhibit the following rectigradations or new characters arising orthogenetically:

(1) Central conules (*C C C*) which successively appear between the proto- and metalophid, then between the meta- and tritolophid (*Trilophodon cooperi*), then between the trito- and tetartolophid (*T. palæindicus*), and so on.

(2) The paired *cones* each divide into two *conelets*, the fissures becoming deeper progressively from the *Trilophodon cooperi* stage to the *T. chinjiensis* stage.

(3) Thus the summits of the internal cones wear into a dumb-bell pattern, then into the *trefoil* pattern, by the expansion of the median conelets into *trefoils*.

(4) Each new ridge-crest is heralded by two small *cones*, as seen also in M_2.

(5) The four *ridge-crests*, or proto-, meta-, trito-, and tetartolophids, are followed by the fifth ridge-crest, or pentalophid, which evolves from a rudimentary condition in *Trilophodon cooperi* into the well-developed *T. chinjiensis* stage. Finally the sixth ridge-crest, or hexalophid, is added in *T. chinjiensis* and *T. macrognathus*.

(6) The pentalophid progresses through *Trilophodon cooperi*, *T. palæindicus*, *T. chinjiensis* into the perfected *T. macrognathus* stage, in which finally the hexalophid is heralded as two rounded cones.

These four ascending species compared with the primitive third inferior molar of *Phiomia osborni* enable us to synthesize the progressive evolution of the *Trilophodon* ridge-crests, cones, conelets, conules, and trefoils, as shown in the table on page 6.

The external elements or *ecto-cones*, conelets, conules, and trefoils evolve most rapidly in the *inferior* molars, while the *ento-cones*, conelets, and trefoils develop more slowly. In the *superior* molars just the opposite rate is observed, the most rapid evolution (Fig. 2) is upon the *internal* elements.

SUPERIOR MOLARS (FIG. 2).—The inferior molars are more rapidly progressive than the *superior* molars in which the cones, conelets, and

trefoils are greatly retarded; for example, in *Trilophodon cooperi* M^2 exhibits six cones, rudimentary internal trefoils, no conules, whereas the third inferior molar, M_3, exhibits eight cones, two conules, and incipient subdivision of several of the cones and conelets.

SUMMARY.—Exclusive of trefoils, *Phiomia osborni* exhibits only ten conical coronal elements; *Trilophodon cooperi* nineteen conical coronal elements; *T. palæindicus* twenty conical coronal elements, plus rudiments of trefoils; *T. chinjiensis* twenty-seven conical coronal elements, with *prominent* ecto-trefoils; *T. macrognathus* twenty-six conical coronal elements, with eight trefoils (see Table, p. 6). A summary of Oligocene-Miocene evolution of M_3 is as follows:

OLIGOCENE: *Phiomia osborni,* length 75 mm., *ten* conical coronal elements
UPPER MIOCENE: *Trilophodon macrognathus,* length 225 mm., *twenty-six* conical coronal elements

It follows that this strictly orthogenetic, rectigradational, progressive evolution of the cones, conelets, conules, ridge-crests, and trefoils constitutes not only a sure means of defining generic, mutational, and specific stages, but it may precisely establish the *geologic horizon* in which these definitely ascending evolutionary stages occur. The specific gaps between these readily distinguishable stages in time will be filled in by intermediate ascending mutations.

GEOLOGIC FAUNAL HORIZONS.—These closely analyzed ascending mutations or stages in the evolution of the third inferior molars afford a new and very valuable time-scale in the ascending geologic horizons of the Upper Siwaliks, as indicated below.

Forster Cooper (1922, p. 609) describes these species as from "Lower Miocene deposits of Dera Bugti in Baluchistan." Recently (letter, Aug. 10, 1932) he states that all the mastodonts of his collection came from quarries near Gandoi or near Kumbhi. It now appears important to determine the exact localities of the type and paratype specimens of *Trilophodon cooperi.*

Forster Cooper also states that no mastodonts were found *in situ* at Chur-Lando, although mastodont specimens were found in various water courses near by. This quarry yielded *Paraceratherium* (Forster Cooper, 1911) *bugtiense* (Pilgrim 1910), a genus which it appears antedates *Baluchitherium osborni* Cooper (1913). The Chur-Lando horizon is further distinguished from the 'Bugti beds' by the presence of

		Ridge-crests	Cones	Conelets	Conules	Trefoils	Total conical elements	Total new elements
Upper Miocene	*Trilophodon macrognathus*	5½	12	19	4	8	26	34
Middle Miocene	*Trilophodon chinjiensis*	5½	12	21	4	14	27	35
Lower Miocene	*Trilophodon palæindicus*	4⅓	10	17	3	6–7	20	27
Basal Miocene	*Trilophodon cooperi*	4⅙	10	17	2	00	19	19
Lower Oligocene	*Phiomia osborni*	3⅓	8	10	2	00	10	10

numerous species of *Chilotherium*, including a stage close to *Chil. tagicus*, also a rhinoceroid stage close to *Brachypotherium depereti* Borissiak, similar to the Jilančik species of equal age. It also contains the genotype of *Gelasmodon gracilis* Cooper (1913) and of *Hemimeryx lydekkeri* Cooper (1913). *Aprotodon smith-woodwardi*, gen. nov., Cooper (1915) proves to be a rhinoceros allied to *Chilotherium* Cooper (1931–1932).

The Chur-Lando life zone, therefore, may be provisionally correlated with the *Indricotherium* Borissiak (1915) life zone, also with the *Baluchitherium grangeri* Osborn life zone of Loh, central Mongolia, which are now regarded as of Middle Oligocene age, thus antedating the Basal or Lower Miocene age of the 'Bugti beds.'

It would appear, therefore, that the 'Bugti beds' as exposed at Gandoi and Kumbhi are of Basal Miocene age and may be designated as the *Trilophodon cooperi* life zone, containing one of the most primitive known species of this Longirostrine Mastodont.

Trilophodon macrognathus of the Upper Chinji is the uppermost trilophodont stage thus far discovered. It is succeeded in the Jammu and Kangra, also in the Dhok Pathan levels, by progressive species of *Tetralophodon* and of *Synconolophus*, which doubtless will yield equally precise means of determining the higher geologic levels.

AMERICAN MUSEUM NOVITATES

Number 586 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Nov. 16, 1932

59.9,32 O (72.6)

A NEW GENUS OF RODENTS FROM YUCATAN

BY H. E. ANTHONY

In a collection of mammals made by Mr. Robert T. Hatt and his wife in Yucatan, the fall of 1929, are two specimens of an apparently undescribed genus of rodents quite similar to *Nyctomys*. Mr. Hatt, an assistant curator in the department of mammals of the American Museum, was engaged in searching through the cave and grotto deposits for fossil remains which might link up with the palæontology of the West Indies, and his work was supported by a grant from the Angelo Heilprin Fund. The collecting of recent mammals was incidental to the search for fossil specimens, and the capture of a type for a new genus was an unexpected development, for the existing mammalian genera of Yucatan were thought to be well known. It gives me pleasure to associate with this discovery the name of the collector, for whom I have named the species.

Otonyctomys, new genus (Cricetidæ)

GENERAL CHARACTERS.—A medium-sized mouse very similar to *Nyctomys*, to which it is closely related, but differing in very much larger auditory bullæ. External ear about as in *Nyctomys*, tail heavily haired, hind foot broad but tarsus not as broad as in *Nyctomys*. Molar dentition weaker, anterior margin of zygomatic plate approximately perpendicular to palatal plane. Mammæ: thoracic, 0; abdominal, 0; inguinal, 2; =4.

GENOTYPE.—*Otonyctomys hatti*, new species.

Otonyctomys hatti, new species

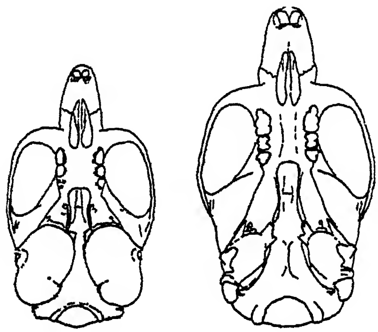
TYPE.—No. 91190, Amer. Mus. Nat. Hist.; ♂ ad.; Chichen Itza, Yucatan, Mexico; October 26, 1929; collector, Robert T. Hatt. The type is a skin, skull, and trunk skeleton. The skin lacks most of the tail.

GENERAL CHARACTERS.—A bright-colored mouse differing in no very noticeable external characters, except color, from the known species of *Nyctomys*. The pronounced russet tone of coloration marks it as the handsomest of the neotropical climbing mice, for none of the *Nyctomys* are as showy. The greatly enlarged bullæ, roughly three times the size of those in *Nyctomys*, are the most obvious character of separation from its relatives in that genus.

DESCRIPTION.—Color above, nearly uniform russet to hazel (color nomenclature that of Ridgway), darkest on back; sides tawny to ochraceous tawny; a blackish spot at base of whiskers and at anterior margin of eye; upper side of hands whitish

washed with warm buff, upper side of feet whitish, metapodials darkened with ochraceous-tawny; pelage of upper parts blackish slate at base; underparts white from base to tip of hair, with suffusion of cream-buff; tail heavily covered with hairs which increase in length from base of tail to tip, 6 mm. long about midway, 16 mm. in length at end of tail, bone-brown in color both above and below; ears of medium size, well furred basally but practically naked otherwise.

Skull in most characters closely paralleling that of *Nyctomys;* rostrum moderately abbreviated; supraorbital beading well developed and continuing practically clear across parietal, across frontal and anterior half of parietal forming a noticeable shelf; zygomatic arch compressed rather than flaring, anterior margin of zygomatic plate with straight margin perpendicular to palatal plane; incisive foramina of moderate size, failing to reach anterior plane of first molar tooth by about half a



a *b*

Fig. 1. *a, Otonyctomys hatti* (A. M. N. H. No. 91190) and *b, Nyctomys sumicrasti salvini* (A. M. N. H. No. 74214).

millimeter; postpalatal notch reaching about midway of last molar tooth; auditory bullæ disproportionally large and occupying most of the basicranial region, almost meeting medially and inflated considerably beyond the ventral plane of hamular process of the pterygoid with which they approximate contact; molars rather weak, noticeably smaller than in *Nyctomys;* mandible slender, with very low coronoid process, weak ascending ramus and very shallow masseteric fossa.

Measurements.—Taken in the flesh (measurements in parentheses are of paratype): total length, 136+(231); length of head and body, 116 (104); tail vertebræ, 20+(127); hind foot (c.u.), 21 (23); height of ear from notch, 14 (14).

Skull (measurements in parentheses are for a *Nyctomys sumicrasti salvini*, No. 74208, ♀, from Panajachel, Guatemala): greatest length, 29.5 (31.5); condylo-incisive length, 26.7 (29.4); length of nasals, 9.3 (9.8); zygomatic breadth, 15.7 (16.8); interorbital breadth, 5.5 (5.7); breadth of braincase, 13.3 (14.5); dimensions of audital bulla, greatest length, 8.9×greatest breadth, 7.0 (4.8×4.9); length of upper molar series, 4.2 (5.2); transverse breadth of second upper molar, 1.1 (1.5); greatest length of mandible, 17.7(20.7); length of lower molar series, 4.1 (5.2).

This new genus has obvious affinities with *Nyctomys* but seems to be sufficiently differentiated to warrant a separation of generic magnitude

The great difference in size of the auditory bullæ in the two genera is not foreshadowed in any way by the bullæ of the known species of *Nyctomys*, for these are consistently comparable and the size differences are scarcely, if at all, discernible to the eye.

Superficially, *Otonyctomys hatti* is much redder than any species of *Nyctomys*, but since the color patterns are identical, except for hue, in the two genera, this difference can have little significance. The two specimens of *O. hatti* display a slight degree of color variation, the type being a shade or two lighter (with more yellow) than the paratype. Unfortunately, neither of these two specimens is perfect, one having a broken skull, the other lacking most of its tail. Because of the great importance of the skull characters, in establishing the new genus the choice of a type specimen fell logically upon the tailless individual with a sound skull.

The two specimens were caught on successive nights in a trap set in a thatched hut, on the shelf formed where the rafters meet the top of the wall. This animal is apparently a climber, as its hind foot would indicate, and doubtless has habits similar to those of *Nyctomys*, *Rhipidomys*, and *Œcomys*. Arboreal habits probably account for the comparative rarity in museum collections of such genera as *Nyctomys*, and even in regions as well known, zoölogically, as our Pacific Northwest, the tree-living *Phenacomys longicaudus* has been captured by very few collectors. *Otonyctomys* may not be an uncommon rodent in Yucatan, and the lateness of its discovery is doubtless due to the fact that the special habitat of this creature has not been thoroughly explored.

AMERICAN MUSEUM NOVITATES

Number 587 | Published by THE AMERICAN MUSEUM OF NATURAL HISTORY New York City | Dec. 15, 1932

56.9: 14.71

MOUNTED SKELETONS OF *EOHIPPUS*, *MERYCHIPPUS* AND *HESPEROSIREN*

BY GEORGE GAYLORD SIMPSON

Three mounts of fossil mammals recently completed in this Museum are of considerable interest and have not previously been figured. The accompanying photographs of *Merychippus* and *Hesperosiren* are by Albert Thomson and that of *Eohippus* by Irving Dutcher.

Eohippus venticolus (Cope)

Amer. Mus. No. 4832 is the classic "*Hyracotherium*" skeleton of Cope, that on which ideas of this earliest stage of horse evolution were originally and principally based. It was collected in the type Wind River of Wyoming by Wortman in 1880, and has frequently been figured.[1] As illustrated by Cope, it lay on its right side in the matrix. After its acquisition by the American Museum, it was mounted under the direction of the late W. D. Matthew as a slab mount, with pose and restored parts almost identical with Cope's figure. This had the disadvantages of being very stiff and unnatural (unavoidable in a matrix mount but seldom admissible in a slab or free mount), of having many restored parts definitely incorrect (as shown by later discoveries), of exposing that side of the skeleton which is much less complete, and of facing the wrong way for inclusion in our horse evolution series as now being rearranged. These serious disadvantages seemed to outweigh the historical interest of retaining Cope's pose and restoration, and the specimen was disarticulated and remounted by Haakon Dehlin under my direction.

As now exhibited, the skeleton is a slab mount, facing to the right. Right fore and hind limbs are nearly perfect, while the left side, now farther from the observer, is poor, the left fore limb being fragmentary and the left hind limb wholly restoration. The head and anterior vertebræ were lowered and the curve of back and tail modified to make them more even and natural. Scapula and pelvis, both lacking as originals in

[1]E.g.: Cope, E.D. 1884. 'The Vertebrata of the Tertiary Formations of the West.' U. S. Geol. Surv. Ter. (Hayden), III. [See Pl. XLIX c, etc.]
Matthew, W. D. 1921. 'Evolution of the Horse.' Amer. Mus. Guide Leaflet, No. 36 (4th Ed.). [See Fig. 8.]

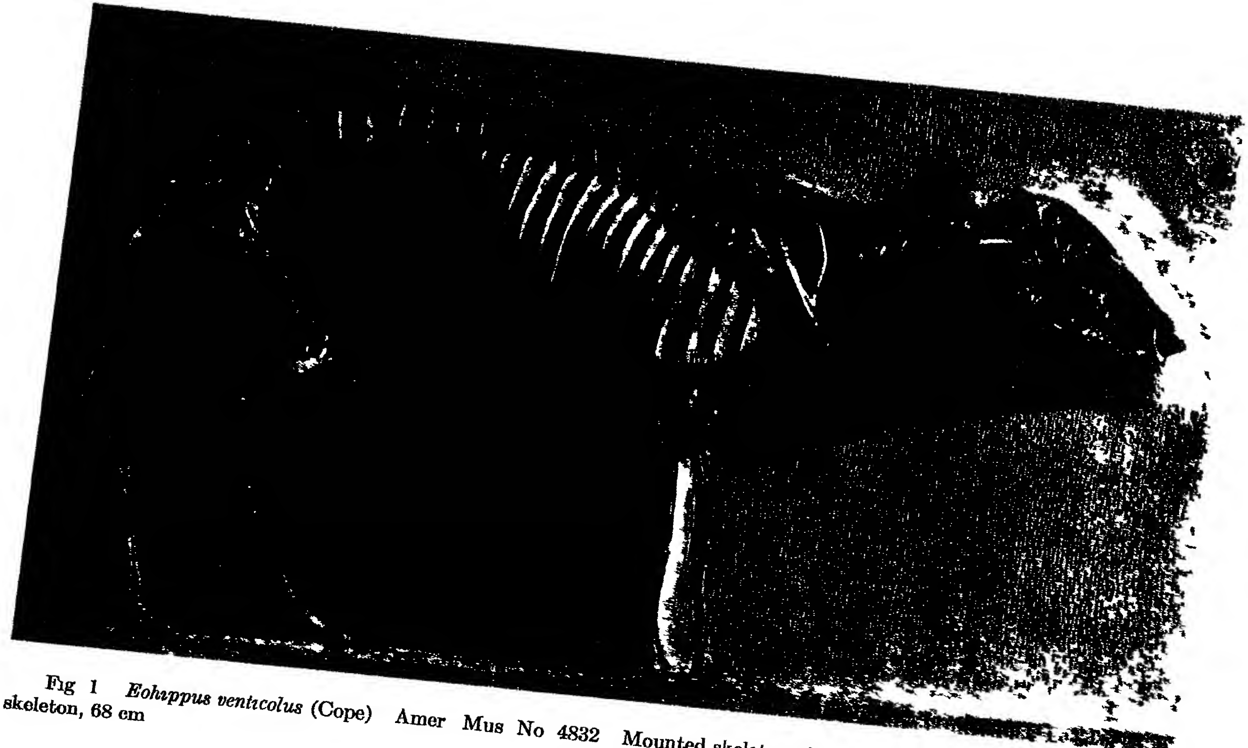


Fig 1 *Eohippus venticolus* (Cope) Amer Mus No 4832 Mounted skeleton, from the right side Length of original skeleton, 68 cm

this specimen, were replaced by much modified restorations based on newer material of *Eohippus*. The neural spines of the posterior cervicals and anterior dorsals were also modified. The scapula was shifted forward and upward, and the feet, formerly posed as extremely unguligrade, were made digitigrade.[1] The number of dorsal vertebræ was reduced from nineteen to eighteen, permitted by the specimen and apparently more probable as well as giving better proportions.

These and other minor changes are believed to reproduce the original structure and pose more nearly than did the old mount, and it is hoped that the present illustration will be used in future in place of the older ones.

As now mounted, the total length is 68 cm. (2 ft. 2¾ in.), the greatest height of the back (at the second lumbar) 37.5 cm., and the height at the fifth dorsal 34.5 mm.

Merychippus isonesus quintus Osborn

Although isolated teeth, jaws, and other parts of *Merychippus* are extremely abundant, mountable skeletons have so far been very rare. For many years such a skeleton has been desired by the Museum. In the revision of our series of skeletons illustrating the evolution of the horse, this stage seemed essential, and as there is no immediate prospect of obtaining a perfect skeleton, it was decided to mount the type of *Merychippus isonesus quintus* Osborn. The dentition and limbs have been partially described and figured by Osborn.[2]

The skeleton, Amer. Mus. No. 14185, was collected by W. D. Matthew in 1908 in the Sheep Creek Beds of Nebraska, Middle Miocene. It has been prepared and restored largely by Albert Thomson, also in part by Jeremiah Walsh and Otto Falkenbach, and mounted by Charles Lang. All the original bone in the mount belongs to a single individual, the missing parts being modeled or cast from other specimens of the genus. As every part is known in one or another of the close relatives of this species, the result is in no respect conjectural and must very closely approximate all the characters of this form.

Of the head of this individual, only left I^{1-2} and P^2-M^3, right P^2-M^3, left I_{1-2}, and P_{2-3}, right I_{1-2} and P_{2-3}, and part of the right maxilla were available. The skull was cast from Amer. Mus. No. 8347, *Merychippus republicanus*, and modified slightly to fit the teeth of this species.

[1]They might perhaps have been even more so, as suggested by Dr. Matthew, who saw this new mount on his last visit to the Museum.

[2]Osborn, H. F. 1928. 'Equidæ of the Oligocene, Miocene, and Pliocene of North America, Iconographic Type Revision.' Mem. Amer. Mus. Nat. Hist., N.S. II, Part I [See pp. 107–108; text fig 81; Pl. XIII, figs. 7, 7*a*; Pl. XIV, fig. I; Pl. XLI, fig. 4; Pl XLV, figs. 2, 5; Pl XLVI, fig. 4.]

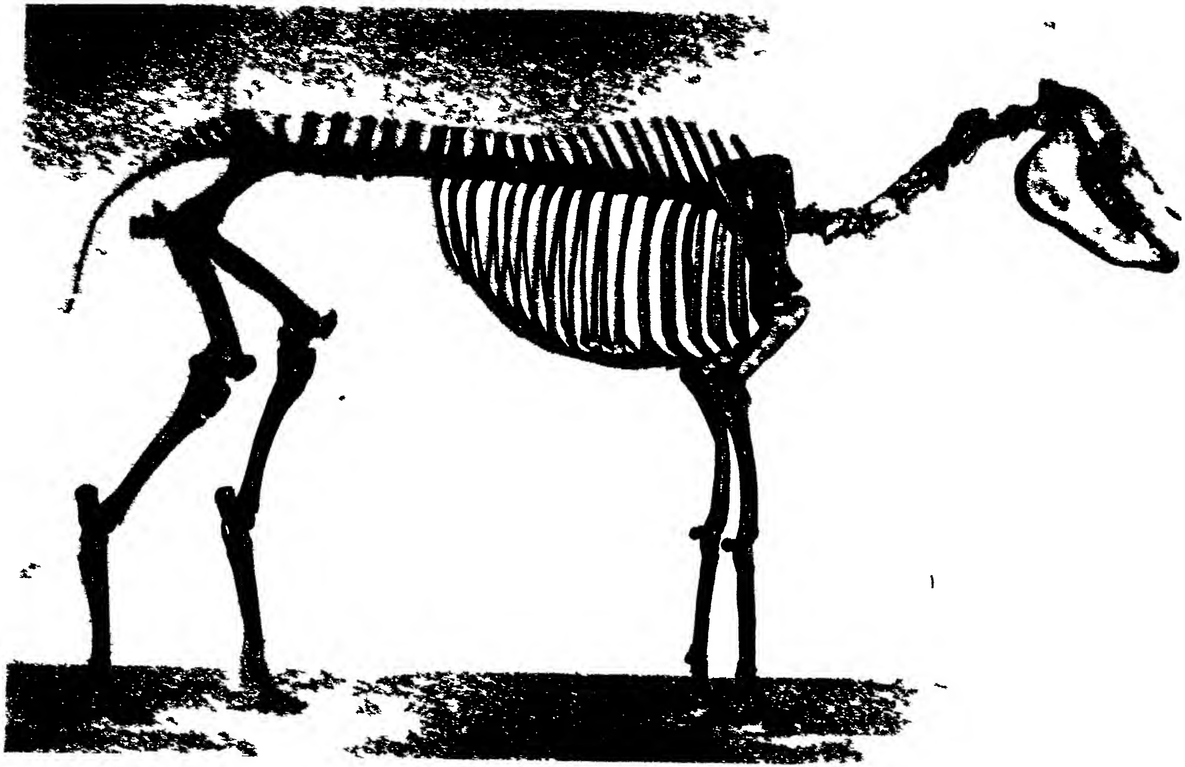


Fig 2 *Merychippus isonesus quintus* Osborn Amer Mus No 14185 Mounted skeleton, from the right side Length of original mount, 161 5 cm

Cervicals 1–3, 7, and part of 4 are original, as are part or all of dorsals 3, 8–10, 12, 14, and 17–18, and lumbars 1–5. Except for the last three pseudo-sacrals or fused caudals, the sacrals and caudals are restored. Parts of 12 ribs of the left side and of two of the right are original. Both scapulæ and fore limbs are almost completely original except the right humerus. The pelvis and the left femur are restored. The right femur and tibia and all metatarsals are in part original and the rest of the hind limbs is fairly complete. The vertebral formula C7, D18, L6 was assigned to the species. The attitude selected is one of repose, with the head slightly elevated above the back, the right fore foot slightly advanced and the left hind foot more distinctly advanced beyond the right. In our horse series, this skeleton will be placed between *Miohippus* and *Pliohippus*, both of which are mounted in somewhat more active poses.

The length, as mounted, is 161.5 cm. (5 ft. 3½ in.), and the greatest height of the back (at the fifth dorsal) 89.5 cm.

Hesperosiren cratægensis Simpson

A mount of this species, including some original parts from another individual but in large part a replica based on this specimen, was prepared for the Florida State Geological Survey and is now mounted in Tallahassee, Florida. That and the present mount are the only skeletons of fossil sirenians of the Western Hemisphere yet mounted. The basis of the mount is Amer. Mus. No. 26838, type of the species, collected by G. M. Ponton and me in 1929 in the Hawthorn Formation, early Middle Miocene, at Quincy, Florida. The skeleton has been described and characteristic parts figured elsewhere,[1] but it was impossible to prepare illustrations of the whole skeleton for inclusion in that paper. The mount is in small part composite, as detailed below. The specimen was prepared by Carl Sorensen and Haakon Dehlin and mounted by Charles Lang.

The skull of the mount is a plaster reconstruction, based on the original skull of this individual which is complete but very fragile and badly crushed. The lower jaw is unknown, but has been modeled to fit the skull and to compare with the known relatives of the genus. The scapula, manus, pelvis, and femur have similarly been restored by comparison with other sirenians. The type individual includes the sixth cervical, part or all of dorsals 1–3 and 6–16, the last lumbar, the single sacral, and the second and third caudals, with at least parts of all the

[1]Simpson, G. G. 1932. 'Fossil Sirenia of Florida and the Evolution of the Sirenia.' Bull. Amer. Mus. Nat. Hist., LIX, pp 419–503. [See pp 427–443, Figs. 1–10.]

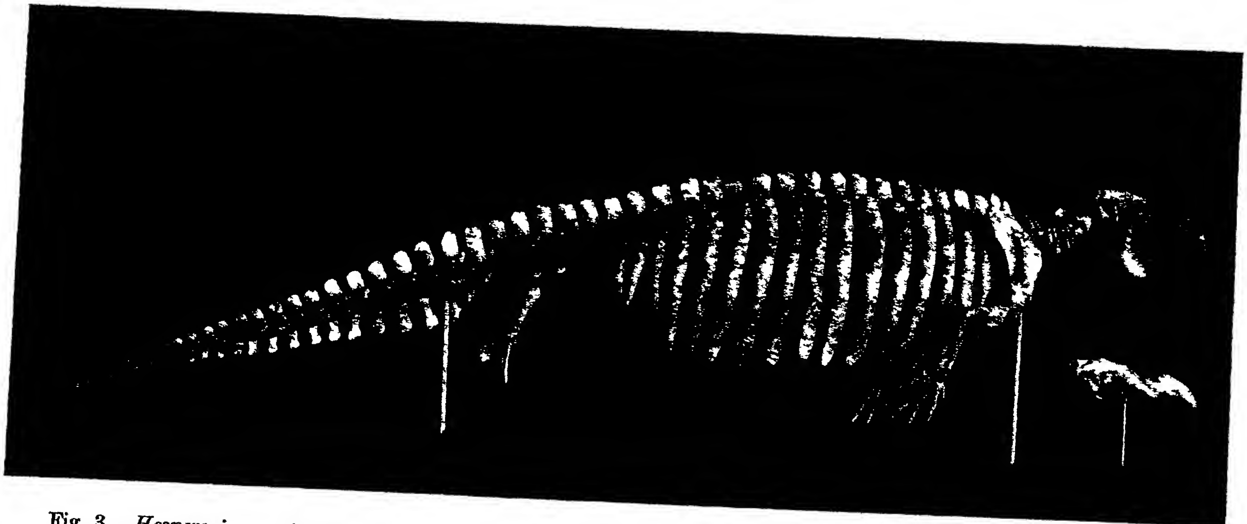


Fig. 3. *Hesperosiren cratægensis* Simpson. Amer. Mus. No. 26838, with slight additions from Amer. Mus. No. 26840 and Amer. Mus. No. 26839. Mounted skeleton, from the right side.

The skull with the skeleton is a replica with crushing corrected, and the original skull of this individual is mounted separately below. Length of mount (between verticals), 304.5 cm.

ribs of the right side except the fifth and a number of ribs from the left side. The fifth cervical, Amer. Mus. No. 26840, is from a topotype. Right and left humeri, and left radius and ulna are from another topotype (Amer. Mus. No. 26839, presented by the Florida State Geological Survey).

In the restoration of missing parts and the arrangement of the bones, all published data on fossil sirenians, the well known cast of *Halitherium schinzi*, and the recent *Dugong* and *Trichechus* have been carefully compared. The skeleton is a free mount in a nearly horizontal position, the fore part slightly raised above the hind and the back gently arched, somewhat less interesting but permitting closer examination and involving fewer technical difficulties than a more vertical or more active pose.

In comparison with the present mount, the well known restoration of *Halitherium schinzi* by Lepsius,[1] which has been widely copied as illustrative of fossil sirenians, differs in several particulars not dependent on purely morphological distinctions. Although the attitudes of vertebral column and fore limb given by Lepsius are doubtless possible, they are stiff and awkward. The ribs as shown by him are too curved and slender and in part at least are directed too much posteriorly. Most important, however, is the pelvis. The pelvic bone shown by Lepsius on the left side clearly belongs on the right. He shows it horizontal, but it is certain from recent sirenians and from the history and mechanics of the bone that it should be more nearly vertical. The end shown as anterior by Lepsius should be directed slightly backward, and that shown as posterior should be nearly in contact with the transverse process of the sacral vertebra. These shortcomings were previously corrected in the paper restoration by Stromer.[2] The cast of Lepsius' species which has hitherto represented the fossil Sirenia in the American Museum exhibition is a careful mount, correct for the most part, but even in it the two halves of the pelvis were on the wrong sides.

The length of the mount of *Hesperosiren* between verticals is 304.5 cm. (10 ft.), and along the curve 320 cm. (10 ft. 6 in.). The living animal, with its caudal fin, would considerably exceed this length. The greatest width (across the twelfth ribs) is 73 cm.

[1]Lepsius, G. R. 1881. *Halitherium schinzi*, die fossile Sirene des Mainzer Beckens. Abh. Mittelrhein. Geol. Ver., I. [Pl. VIII.]

[2]Stromer v. Reichenbach, E. 1912. 'Lehrbuch der Paläozoologie.' II Teil: Wirbeltiere. [See Fig. 211.]

AMERICAN MUSEUM NOVITATES

Number 588 — Published by The American Museum of Natural History, New York City — Dec. 31, 1932

55.26

ARE THERE LIVING BACTERIA IN STONY METEORITES?

By Charles B. Lipman

In discussing, about six years ago, my investigations on living bacteria in rocks,[1] with Professor W. J. Mead of the University of Wisconsin, I received the suggestion to make a search of stony meteorites (aërolites) for possible living microörganisms in them. This suggestion was very interesting, and I decided to act thereon if I could obtain proper specimens for study. It would be too long a story to tell here of the difficulties and delays which I experienced in obtaining an adequate number of usable specimens of stony meteorites. Suffice it to say that during the six-year period in question, I have had the good fortune, through gift and purchase, to obtain several good specimens of aërolites, and I have subjected nearly all of them to study by methods described below. Acknowledgments for gifts of meteorite specimens for the purposes of my study are made below. The specimens were all completely or nearly completely crusted and were all small, weighing from fifty grams or less to several hundred grams.

The results of my search for living microörganisms in meteorites, together with my interpretations of them, are given in the following pages. The reader will note that I am not entering into any apology or justification for my study and for this report thereon. I desire to let my statement of findings and my discussion and conclusions respecting them speak for themselves.

GENERAL EXPERIMENTAL TECHNIQUE

It is at once obvious that in any such crucial experiments as these for the determination as to whether living cells exist in stony meteorites, the item of technique of the investigation is of paramount importance. The arrival at the most desirable technique was a matter of evolution, and a number of meteorite specimens had to be sacrificed more or less in the process. The general idea, however, remained the same throughout, viz., an attempt was made to remove from the surface of the speci-

[1]See the following papers:
Lipman, Charles B. 1928. 'Discovery of Living Microörganisms in Ancient Rocks,' Science, LXVIII, No. 1760, pp. 272–273, Sept. 21.
Lipman, Charles B. 1931. 'Living Microorganisms in Ancient Rocks,' Journal Bacteriology, XXII, 3, September.

men all organisms which might be attached to dust or other adhering substances. This was attempted by first washing the surface of the specimen thoroughly with soap and hot water with the aid of a sterile brush. The specimen was then rinsed in distilled water, dried with a paper towel and placed in a solution of a bactericide. At first, solutions of $HgCl_2$ (concentration of 1 to 1000) were used, and periods of exposure thereto varied in different experiments from one to one and one-half hours. Later, superoxol, a 30% solution of H_2O_2, was used for periods varying generally from three to six hours. The substitution of superoxol for $HgCl_2$ was made because of the suspicion that $HgCl_2$ reacts with some of the constituents of the meteorites and therefore remains in them and possibly poisons the media into which they are transferred later. After the exposure of the specimen to the bactericide for the desired period, it was transferred to 95% alcohol for half a minute to a minute, grasped with sterile tongs and exposed to a large gas flame until the alcohol had all burned away and for a few seconds more. In the early experiments, it was then quickly thrown into a sterile iron mortar and crushed, and the powder distributed with a sterile spoon into several flasks of sterile media. In the latter experiments, however, the specimen was dropped directly from the flaming procedure just described into a wide-mouthed flask containing one of the best adapted media in sterile condition. In such media, the specimen remained for periods varying from two or three weeks to four or five months, and if no growth was evident, the supernatant fluid was plated and poured off, the flask being thoroughly flamed before and after opening, and the specimen dropped into a sterile mortar and crushed as described above. The sterile mortars were prepared and guarded with the greatest care and the technique involved was as described elsewhere[1]. Wherever growth appeared in the small culture flasks of liquid medium into which the meteorite powder from the mortar was introduced, it was studied directly under the microscope and by plating. Practically all of the manipulation involved in these experiments was carried out in an inoculation chamber specially sterilized every time it was used, by many hours of fumigation with formaldehyde vapor and steam. Everything used in the experiments was sterilized by the most drastic means. Glassware and tongs were heated for twenty-four hours or more at 165° C. The mortars were heated at the same temperature for several days. Liquid and solid media were sterilized in the autoclave two or three times before using, each exposure being from one to three hours at 20 pounds steam pressure. Except as described

[1]1931. 'Living Microörganisms in Ancient Rocks,' Journal Bacteriology, XXII, 3, September.

otherwise below, incubation of cultures was at 28° C. in a special incubator room, and all culture flasks during and before incubation were protected against contamination by capping cotton stoppers with filter paper which had been dipped in $HgCl_2$ solution.

The foregoing description gives an idea of the technique employed in general, other information with respect to technique being given below in some detail in connection with each experiment described.

PRELIMINARY EXPERIMENTS

Under the designation of preliminary experiments are grouped here arbitrarily all those carried on with meteorite specimens which were not accorded the most refined methods of manipulation developed during the entire study, since results obtained in these earlier, less thoroughly controlled, experiments are less dependable and therefore require separate and briefer discussion. As in the case of the more complete experiments, the results obtained with each specimen and other data relative thereto will be described separately.

Laboratory Number 235

U. S. National Museum, Washington, No. 656. Weight, 69 grams. Found in Ness County, Kansas, 1898.—Mrs. Comley Ward.

Treatment.—Washed as described above, exposed to $HgCl_2$ solution for 1 hour. Rinsed in sterile distilled water. Placed in alcohol, flamed, dropped into sterile mortar. Crushed. Distributed into flasks of liquid media.

Results.—Growth obtained in three out of five flasks of sea-water peptone and tap-water peptone media. Rods of medium length and thickness. Tendency to form chains. Some much shorter than others. Apparently spore-formers. Also long and thin rods forming spores. Also large *Torula*-like cells.

Laboratory Number 238

U. S. National Museum No. 189. Found in Forest City, Iowa.

Treatment.—Washed, exposed to $HgCl_2$ (1 to 500+HCl) for 1 hour. Rinsed in sterile H_2O, placed in alcohol, flamed, dropped into mortar and crushed. Distributed into four flasks of sea-water peptone medium.

Results.—Growth obtained in all cultures. Limited to long rods of medium thickness and short plump rods. Growth good also in other media than one first tried. All rods spore-forming.

Laboratory Number 239

U. S. National Museum No. 654. Found in Ness County, Kansas.

Treatment.—Same as in No. 238.

Results.—Growth obtained in three out of five culture flasks. Rods of medium length, slender, and also shorter plump rods.

Laboratory Number 262

American Museum of Natural History, New York, No. 246. Found in Forest City, Iowa. Weight, 60.9 grams.

Treatment.—Washed, rinsed in distilled water, placed in superoxol for 2 hours, transferred to alcohol, flamed, and dropped into flask of sterile tap-water-peptone medium. After two weeks, medium still clear. Flask flamed, medium poured off, specimen dropped into a sterile mortar and crushed. Powder distributed into tap-water-peptone and into sea-water-peptone media.

Results.—No growth in sea-water-peptone medium. Two out of four flasks in tap-water-peptone medium give growth of very short rods and coccus forms. No growth in nitrification medium. In sea-water-sulphur autotrophic medium, a giant form developed 12μ long $\times$ 5μ wide.

Laboratory Number 283

Ward's Natural Science Establishment, Rochester. Found in Navajo County, Arizona. Fell July 19, 1912. Weight, 54 grams.

Treatment.—Washed, rinsed, placed in superoxol for 3 hours, then in alcohol, flamed and dropped into large flask of tap-water-peptone medium. After two weeks, medium remained clear and plates made therefrom found negative. Specimen again placed in alcohol and flamed, and then dropped into sterile mortar and crushed. Powder distributed into tap-water-peptone medium.

Results.—No growth in any flask. Transfers to sea-water-peptone also negative throughout. Transfers to starch medium show growth in three out of four cultures, all being rods medium length and width, and in addition one coccus form.

Laboratory Number 285

Ward's Natural Science Establishment. Found 1891, Long Island, Phillips County, Kansas. Weight, 56.5 grams.

Treatment.—Washed, placed in superoxol 3 hours, then in alcohol, flamed and dropped into large flask of tap-water-peptone medium. One week later no evidence of growth, flask flamed, medium poured off, specimen again placed in alcohol and flamed, dropped into sterile mortar and crushed. Powder distributed into four flasks each of tap-water-peptone and sea-water-peptone.

Results.—No growth in sea-water-peptone media. Short rods in two out of four tap-water-peptone cultures. Rods rather thick and contain spores.

Laboratory Number 356

Ward's Natural Science Establishment. Found in 1898, Ness County, Kansas. Weight, 156 grams.

Treatment.—Washed, placed in superoxol for six hours, dipped in alcohol, flamed and preserved in sterile beaker for three weeks. Again treated as just described and then dropped into sterile mortar and crushed. Crushing not successful, specimen being very hard—only a little powder obtained. This was distributed into several different media, but no growth was obtained in any culture. The uncrushed part of the meteorite (nearly all of it) was for a third time treated as described above and crushed, this time successfully. Powder distributed in coal-extract-peptone, soil extract+meteorite powder peptone, and algal medium.

Results.—Short bacilli found in all except one flask of soil extract-meteorite powder-peptone. Rods occurring mostly singly, sometimes in pairs. No growth in algal medium. No growth in sulphur-oxidizing, nitrifying or Bastin's sulphate reducing media.

SECONDARY EXPERIMENTS

With the experience gained from the foregoing experiments, it was possible to plan more complete and more uniform procedures in additional studies on new specimens. Hereinbelow will be found notes on such later experiments. Practically every test made with a meteorite specimen is given here, so that the reader may see as nearly as possible the whole picture of these investigations.

Experiments with the first three specimens in this group proved unfortunate, since it was not possible, in the case of any one of them, to free the surface of the specimen from bacteria even by the very drastic treatment of repeated exposures for six hours each time to superoxol. They were all crushed and studied, however, after being treated as indicated below.

Laboratory Number 357

Ward's Natural Science Establishment. Found 1912, at Holbrook, Navajo County, Arizona. Weight, 71 grams.

Treatment.—Washed as described for specimens in preliminary experiments above. Dried and placed in superoxol for six hours. Dipped in alcohol, flamed and dropped into large flask of sterile 1% peptone coal-extract medium. Placed in incubator. In five days, the medium was found to be turbid and growth found therein. The specimen was removed from the medium, washed and re-treated as before except that three hours only were allowed for the exposure to superoxol. Four days later, the medium was found to be turbid and growth found therein. The specimen was removed from the medium, treated as in the second treatment just described, but was not replaced in new medium as a whole, since it seemed impossible to remove all bacteria from the surface by such treatment. Instead the specimen was dipped in alcohol, kept in a large flame for about 20 seconds, dropped into a sterile mortar, crushed and distributed into the following media: peptone coal extract, and soil extract plus meteorite powder.

Results.—In both media, growth developed showing short rods in the peptone coal-extract medium, and short rods and cocci in the soil extract-meteorite powder medium.

Laboratory Number 358

Ward's Natural Science Establishment. Found at Holbrook, Navajo County, Arizona. Fell July 19, 1912. Weight, 56 grams.

Treatment.—Washed and treated as in Series 356 and 357, and dropped into flask containing 150 c.c. 1% peptone coal extract and incubated at 28° C. In five days, the medium was turbid. Specimen was then removed from turbid medium,

scrubbed again, flamed for about 20 seconds and placed in 200 c c. of fresh sterile medium of the same kind as before. In four days, the medium was turbid again. The specimen was removed and again treated as before. Again turbidity developed in four days, and the same experience resulted in three additional successive treatments. Attempts to sterilize the surface of the specimen were then discontinued, and as in

Fig. 1. Isolated from Holbrook Meteorite, Laboratory Series No. 358, 24-hour culture in sodium sulphide peptone soil extract medium. ×1750.

Series 357, the meteorite was thoroughly washed, placed in alcohol and kept in a large flame for 20 seconds. It was then aseptically transferred to a sterile mortar and crushed. The powder was then distributed into sterile peptone coal extract, soil extract plus meteorite powder, and starch medium.

Results.—Of six flasks thus inoculated, two gave growth showing coccus forms and short rods.

Laboratory Number 359

Ward's Natural Science Establishment. Found May, 1906, Elm Creek, Lyon County, Kansas. Weight, 38 grams.

Treatment.—The specimen was treated as in the cases of Series 357 and 358. The same experience resulted in attempts to free the surface of the meteorite of bacteria. After four successive attempts in which the surface of the meteorite yielded growth in sterile peptone coal extract, the specimen was crushed after another treatment for three hours in superoxol, dipping in alcohol and flaming for 20 seconds. The powder was distributed into peptone-coal extract, soil extract plus meteorite powder, and Bristol's Algal Medium. The flasks were then incubated at 28° C.

Results.—Only one flask of the six inoculated with the meteorite powder showed growth. This proved to be bacilli occurring in long chains and a few coccus forms.

GENERAL COMMENTS ON THE FOREGOING EXPERIMENTS AND THE FINAL EXPERIMENTS

The experience gained with the two groups of specimens as detailed above under "Preliminary Experiments" and "Secondary Experiments" leaves one in doubt as to whether bacteria occur in living form in the interior of stony meteorites. However, two important lessons were learned from those experiments. The first lesson was that it is essential to determine beyond question that the surface of the meteorite is free from bacteria before crushing it, and the second lesson was that drastic methods must be employed at the first treatment of a meteorite in order to clear its surface of any living cell. After all the foregoing experiments, therefore, I determined to profit by these lessons and continue the experiments with new specimens and with redoubled vigilance as regards the technique employed, with the results indicated below.

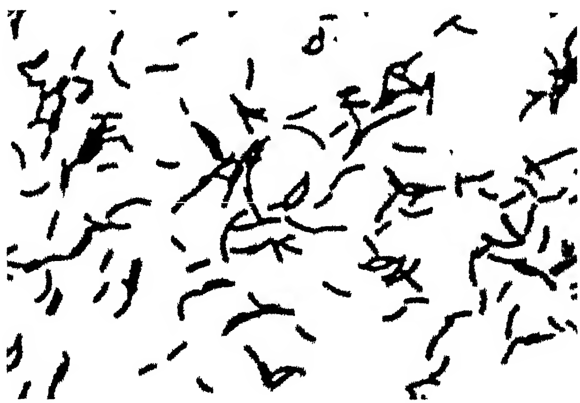


Fig. 2. Isolated from Modoc Meteorite, Laboratory Series No. 377, 24-hour culture in soil extract medium. ×1750.

FINAL EXPERIMENTS

LABORATORY NUMBER 377

American Museum of Natural History, Catalogue No. 2440. Modoc, Scott County, Kansas. Fell 9:30 P.M., September 2, 1905. Veined, white hypersthene-chondrite. Weight, 162 grams.

TREATMENT.—Specimen scrubbed with new soap and hot tap-water, using sterile hand-brush, rinsed in sterile water, and dropped into a beaker of superoxol. Left there for 3½ hours, then removed, rinsed in 95% alcohol, flamed in a large flame and dropped into a flask containing sterile peptone soil extract. This was on March 19.

1931. The medium was still absolutely clear on May 20, 1931. The medium was then quickly poured off, after thoroughly flaming the mouth of the flask, and the specimen was dropped into a sterile mortar and crushed. With a very hot sterile

Fig. 3. Isolated from Modoc Meteorite, Laboratory Series No. 377, 24-hour culture in soil extract medium. ×1750.

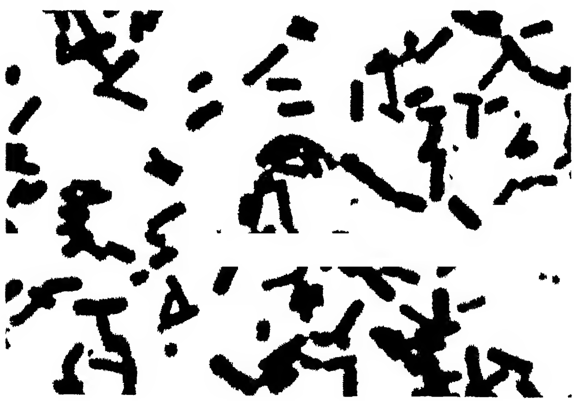


Fig. 4. Isolated from Modoc Meteorite, Laboratory Series No. 377, 24-hour culture in soil extract medium. ×1750.

spoon, the powdered substance was then distributed into several flasks, each of different media as shown below. The solution from the original flask was plated to determine whether it was sterile. No growth except two or three mold colonies developed on these several plates.

Results.—The results obtained with the solution cultures are given in the following table, which summarizes not only examinations of the flask cultures after adequate incubation at 28° C., but also the results of isolation of the organisms concerned after they were plated.

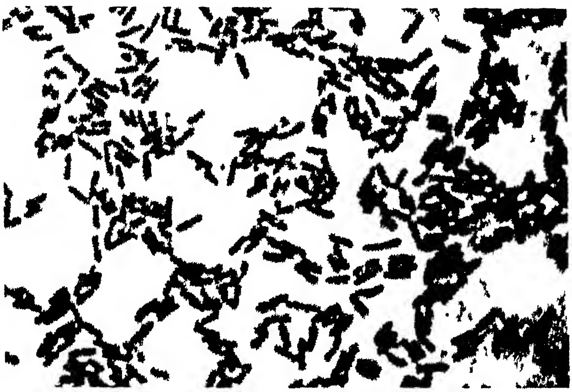


Fig. 5. Isolated from Modoc Meteorite, Laboratory Series No. 377, 48-hour culture in sodium sulphide peptone soil extract medium. ×1750.

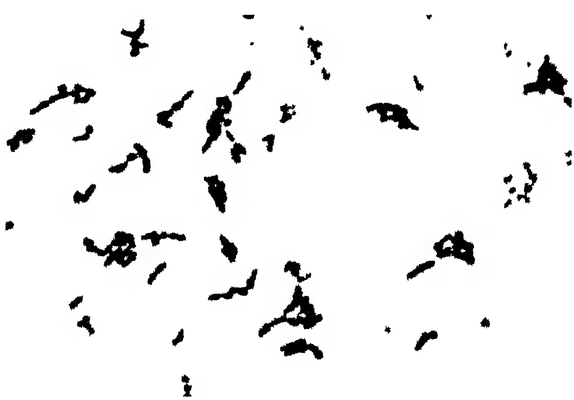


Fig. 6. Isolated from Modoc Meteorite, Laboratory Series No. 377, 24-hour culture in sodium sulphide peptone soil extract medium. ×1750.

TABLE I

Medium	No.	Growth or No Growth	Kinds of Organisms
5% Peptone soil extract	a	+	Rods and coccoid cells.
" " " "	b	+	Medium-sized and minute rods.
" " " "	c	+	Same as Culture *a*.
" " " "	d	+	Rods and coccoid cells.
1% Na_2S peptone soil extract	e	+	Small rods and coccoid forms.
" " " " "	f	+	Same as Culture *e*.
" " " " "	g	+	Same as Cultures *e* and *f* but also larger rods.
" " " " "	h	+	Only a few short rods.
Sodium thiosulphate medium	i	—	———
" " "	j	—	———
" " "	k	—	———
1% Peptone coal extract	l	+	Short rods and coccus forms, but contaminated with a mold.
" " " "	m	—	———
" " " "	n	—	———

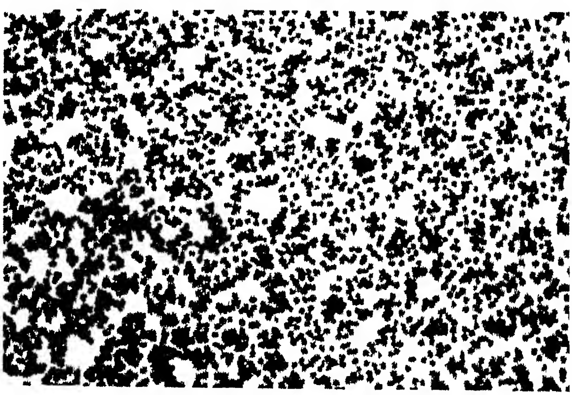


Fig. 7. Isolated from Modoc Meteorite, Laboratory Series No. 377, 24-hour culture in sodium sulphide peptone soil extract medium. ×1750.

Because of lack of space, I am omitting to detail here the description of the many series of dilutions made from these cultures, and of the types of colonies studied on the plates made from each culture flask.

The colonies from the Na_2S peptone soil extract medium yielded mostly coccus forms varying in size, while the peptone soil extract medium yielded mostly rods varying considerably in size. Frequently the cultures showing small rods originally, yielded colonies with medium-sized and even large rods in successive platings. It will be noted that the soil extract peptone and the same medium plus Na_2S were favorable media for the meteorite organisms, but the other two media were apparently

Fig. 8. Isolated from Modoc Meteorite, Laboratory Series No. 377, 4-day-old culture in sodium sulphide peptone soil extract medium. ×1750.

not well suited to their development. Sub-cultures made from the original flasks into still other specialized media gave the following results in summarized form. In Bristol's Algal Medium, incubated in subdued light, coccus and rod forms developed from most of the cultures but not as abundantly as in the more favorable media. In Lieske's sulphur oxidizing medium, only one culture developed a few medium-sized rods. In Jacobsen's sulphur-oxidizing medium, growth was obtained in two transfers from culture *b* (see table I above).

Laboratory Number 388

American Museum of Natural History. Catalogue No. 1155. Holbrook, Navajo County, Arizona. Fell 7:15 P.M., July 19, 1912. Crystalline, spherical, hypersthene-chondrite. Weight, 252.5 grams.

Treatment.—Specimen was scrubbed with hot water and soap, and rinsed in sterile tap- and distilled water, successively. Then placed in a sterile beaker and covered with superoxol. Remained thus for 5 hours with occasional shaking. Re-

moved from superoxol with sterile hot tongs into 95% alcohol. Removed from alcohol with sterile hot tongs to a large flame. After 15 seconds in flame, dropped into a sterile solution of .1% Na_2S–.25% peptone-soil extract. Flask broken by impact of specimen. The latter then again grasped with sterile forceps, dipped in alcohol and flamed for 20 seconds more in a large gas flame and then dropped into another flask of sterile medium like that just described. This was on October 10, 1931. It was incubated at 28° C.

On December 17, 1931, after the medium had remained clear for more than two months, the flask was taken from incubator into a sterile inoculating chamber. Some of the solution was plated to determine sterility. The balance of the solution was then quickly poured off after thorough flaming of mouth of flask, and the meteorite dropped into a sterile mortar (40 hours at 168° to 170° C.) and crushed. With sterile, very hot spoon, the powder was distributed into sterile culture media in Erlenmeyer flasks. The following media were used: Nitrifying medium, nitrogen-free mannite, Bastin's Na_2S peptone soil extract, peptone coal extract, coal extract, Bristol's Algal Medium, Jacobsen's sulphur oxidizing, 2% calcium lactate sea-water, soil extract, and Bavendamm's H_2S medium. All cultures were in duplicate and all incubated as in all other series at 28° C.

RESULTS.—The solution surrounding meteorite which was plated as described above gave no growth whatever.

Growth was obtained in the media inoculated with meteorite powder only in two media, viz., soil extract and Na_2S peptone soil extract. In all these cases, the organisms grew sparsely and were bacilli of medium thickness and length. The bacilli were very variable and in some cases were like egg-shaped cocci.

It is remarkable that growth was obtained at all in these cultures, since, as will be noted above, the meteorite not only received drastic chemical sterilization, but in addition was heated twice in a large flame. The conductive properties of the meteorite are very high because of the large amount of metallic substance therein, and hence some organisms in the specimen must have been destroyed before the stone was crushed.

LABORATORY NUMBER 393

Colorado Museum of Natural History, Denver. Johnstown Meteorite, No. 4450, 123 G. Fell at 4:20 P.M., July 6, 1924.

TREATMENT.—Specimen scrubbed with hot water and soap—sterile brush. Rinsed successively in sterile tap- and distilled water. Immersed dry in superoxol and left there for 4 hours and 25 minutes. Then removed with hot sterile tongs to 95% alcohol. After a few seconds removed from alcohol with hot sterile tongs as before to a large gas flame and heated for about 15 seconds. Then dropped into large flask of sterile medium like that used in Series 388 above. As in all other cases, cotton stopper of flask covered with filter paper cap moistened with $HgCl_2$ solution and tied under mouth of flask. These operations were carried out on January 29, 1932. The flask was then placed in the incubator at 28° C.

On March 10, 1932, the medium having remained clear for about six weeks, the flask was removed from incubator to sterile inoculating chamber, cap and stopper removed and mouth of flask very heavily flamed in large gas flame and solution sur-

rounding meteorite poured off. After this and further flaming of the mouth of the flask, the specimen was dropped into a sterile iron mortar (50 hours at 160° to 165° C.). Specimen was then crushed and distributed into the following media in solution in Erlenmeyer flasks: Jacobsen's sulphur oxidizing, Bavendamm's H_2S medium, Bristol's Algal Medium, Scales' medium minus cellulose, Na_2S peptone soil extract, peptone soil extract, peptone coal extract, coal extract, and Bastin's medium. All cultures were in duplicate, and all incubated as in all other series at 28° C.

RESULTS.—Growth developed quickly in some cultures and slowly in some other cultures. Observations are given in the following table:

TABLE II

Medium	Culture No.	Growth or No Growth	Kinds of Organisms
Peptone coal extract	1	+	Principally large rods (*B. megatherium*) and also small slender rods.
" " "	2	+	Principally large rods (*B. megatherium*) and also small slender rods.
N_2S peptone soil extract	1	+	Small coccus and some small rods.
" " " "	2	+	Small coccus and some small rods.
Peptone soil extract	1	+	Numerous small cocci and some large and small rods.
" " "	2	+	Same rods but no coccus forms.
Jacobsen's sulphur oxidizing	1	+	Medium to large coccus and diplococcus.
	2	—	
Coal extract	1	—	
" "	2	—	
Bastin's	1	+	Large rods (*B. megatherium*), also some slender rods.
"	2	+	Large rods (*B. megatherium*), also some slender rods.
Scales' minus cellulose	1 and 2	—	
Bavendamm's H_2S	1 and 2	—	
Bristol's Algal	1 and 2	—	

LABORATORY NUMBER 394

Colorado Museum of Natural History. Fragment of Johnstown Meteorite. Same source as Series 393 above. Museum Catalogue No. 4443, 49G.

TREATMENT.—This specimen was a small duplicate of the one in Series 393 above. It was treated in the same way. The results are given below.

RESULTS.—Of the several media tested with this small fragment of the Johnstown meteorite as listed in Series 393, only two media in the incubator yielded growth, viz.: In peptone soil extract, large variable rods were obtained in abundance (*B. megatherium*). Occasional coccus forms visible. In Na_2S peptone soil extract, very short rods or egg-shaped coccus forms, and also large variable rods in small numbers (*B. megatherium*). In addition, the Bristol's Algal Medium was examined and found in this case to contain large rods and large ovoid cells, and some fairly large coccus forms. Some cells there also appeared to be yeast-like or *Torula*-like.

Fig. 9. Isolated from fragment of Johnstown Meteorite, Laboratory Series No. 394, 24-hour culture in sodium sulphide soil extract medium. ×1750.

LABORATORY NUMBER 403

Field Museum of Natural History, Chicago. Mocs, Catalogue No. 1447. Fell February 3, 1882. Weight, 109 grams.

TREATMENT.—Specimen treated like that in Series 393, except that only 3 hours and 10 minutes' exposure were allowed for superoxol, and the heating in the open flame after dipping in alcohol was carried out in a specially devised large gas burner with a flame giving a temperature in excess of 1000° C. for about 15 seconds. This was very drastic heating as compared with that used in earlier series and significant for reasons given above. This was done on May 17, 1932. About three weeks later, on June 6, 1932, the specimen was crushed in a mortar sterilized for 80 hours at 155 to 160° C. Inoculations were carried out as before in a thoroughly sterilized inoculation chamber treated with formaldehyde and steam, and cheese-cloth masks were worn by the operators. The meteorite powder was then inoculated into sterile media, as follows: Na_2S peptone soil extract, peptone soil extract, peptone coal extract, Bastin's, Scales' minus cellulose, and Bristol's Algal Medium.

RESULTS.—Control plates exposed in the inoculation chamber after all inoculations had been made. Four plates exposed by passing through atmosphere of chamber three times each, developed no colonies. One plate exposed for one-half minute in

chamber developed one mold colony and the other similarly exposed developed two mold colonies.

Cultures in Na_2S peptone soil extract yielded a number of colonies on the plates, consisting of slender rods of medium length, short rods and cocci.

Cultures in Bastin's, a few colonies consisting of coccus forms, and in one culture an organism like *B. megatherium.*

Cultures in peptone soil extract yielded a number of colonies consisting of short rods.

Other media yielded no colonies.

After heating at 40° C., the cultures gave no growth except those in peptone soil extract which again yielded several colonies consisting of egg-shaped cocci or very short rods.

Plates placed in ice chest at about 5° C. developed no colonies.

Laboratory Number 404

Field Museum of Natural History, Chicago, No. 291. Pultusk. Fell January 30, 1868. Weight, 117.0 grams.

Treatment.—This specimen was treated exactly like the Mocs meteorite in series just preceding, on May 17, 1932. On June 6, it was crushed by the same

Fig. 10. Isolated from Pultusk Meteorite, Laboratory Series No. 404, 15-day-old culture in peptone coal extract medium. ×1750.

technique as that used in Series 403 and the powder distributed into same kind of media.

Results.—Plates poured with solution of Na_2S soil extract, in which specimen as a whole was incubated, were entirely without growth after several days, and the sterility of the inoculation chamber was tested by the same control plates described above. The plates made after several days' incubation of the original solution cultures made with the meteorite powder gave the following results:

Peptone coal extract: Heavy growth. Very irregularly shaped colonies, small and opaque. Streaked plates gave two types of colonies, one tiny pink and the other larger pink. Both colonies gave the same type of organism, an irregular rod mixed

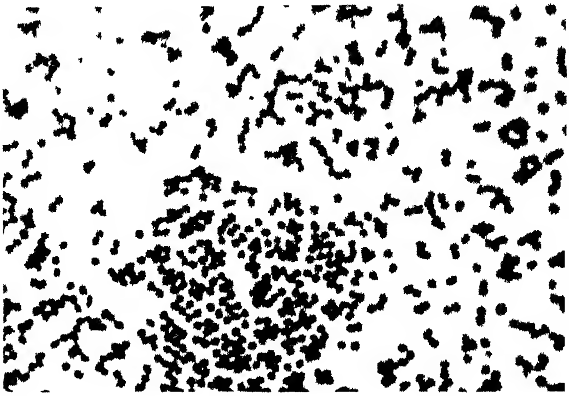


Fig. 11. Isolated from Pultusk Meteorite, Laboratory Series No. 404, 25-day-old culture in Scales' medium minus cellulose. ×1750.

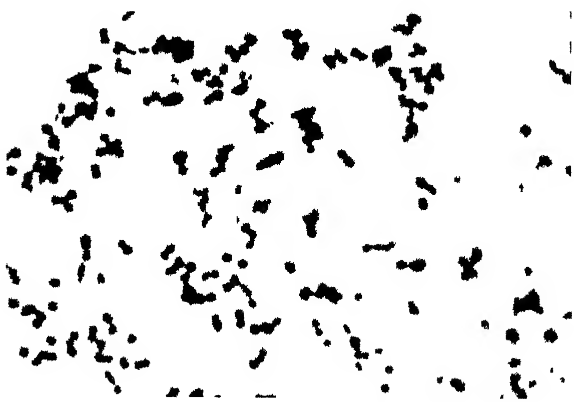


Fig. 12. Isolated from Pultusk Meteorite, Laboratory Series No. 404, 25-day culture in peptone coal extract agar, kept in ice chest at 5° Centigrade. ×1750.

with coccus forms. This is found to be a remarkable organism not only as regards its morphology but also as regards its physiology. It grows well in an autotrophic Scales' medium minus cellulose, rendering the solution turbid, also in peptone media and in Jacobsen's sulphur oxidizing medium (also autotrophic). In Scales' medium

plus paraffine, it attacks the paraffine readily. In the original culture, it started as a peculiar rod in clumps. By sub-culturing, it gradually became transformed into a perfect coccus. At 5° C., it produced polygonal-shaped colonies of two types which again gives a picture of variable rods in branching order along with coccus forms.

Peptone soil extraçt: Only two colonies produced. One consists of a coccus, and one of a large rod. These colonies may be invaders.

Na_2S peptone soil extraçt: Only two colonies produced. One yields an egg-shaped coccus of variable size and shape, and the other a rod of variable size and shape. These colonies may be invaders.

All other media yielded no growth.

At 40° C., no growth was obtained in any of the cultures. The only definite evidence of bacteria in this meteorite was that in one peptone coal-extract culture which yielded the very unusual organism described above in abundance, and this could not have come from any other source than the meteorite itself, considering the conditions of the experiment as described above and the highly unusual nature of the organism. This is especially remarkable since the Pultusk meteorite specimen has lain fallow since 1868.

GENERAL DISCUSSION OF THE STUDY

The evidence submitted in the foregoing pages leads the author to conclude that stony meteorites (aërolites) bring down with them from somewhere in space a few surviving bacteria, probably in spore form but not necessarily so, which can in many cases be made to grow on bacteriological media in the laboratory. These bacteria are similar to forms common on our earth and probably identical with some of our forms. Some of these are pictured in microphotographs which accompany this paper. I realize, of course, that such experiments as I have described above and the conclusion to which I have directed the reader's attention above will be challenged by competent critics, and probably more so by critics who are not competent. Naturally, I do not desire my conclusion to be accepted unless the force of fact and logic are on my side. To assist in clear and critical thinking upon this subject, I submit the following reasons against and for my conclusion and leave the rest to competent judges.

As opposed to the author's conclusion, the following may be urged:

1. Stony meteorites contain very little organic matter for the support of saprophytes.

2. The number of bacteria found per gram of meteorite is evidently very small; hence they may be invaders.

3. The heating of the meteorite in its descent through our atmosphere would destroy bacteria.

4. Some batches of powder from one and the same meteorite yield growth while others do not.

5. While it was lying on the earth, and before being found, water with bacteria may have seeped into the meteorite.

6. Organisms found in these studies are too much like or identical with earth bacteria.

As favoring the author's conclusions, the following answers to the foregoing criticisms should be observed:

1. Stony meteorites do not contain much organic matter, but they do contain some, as is shown in analyses which have been published in meteorite catalogues in respect to organic carbon. In addition, I am publishing in American Museum Novitates No. 589, concurrently with this paper, some data on nitrogen content of stony meteorites which show them all to contain a little combined nitrogen, probably organic in nature. So far as I am aware, these are the only figures known for nitrogen in meteorites.

2. Small numbers of bacteria in meteorites as well as in rocks do not by any means justify the objection above. I have shown elsewhere, and shall soon publish other data to the same effect, that in rocks and rocky matter only a few of many original organisms survive, probably in some resting stage, and that they may exist in the rock here and there sporadically. This is more natural than that they should remain numerous and uniformly distributed in such matter as rocks.

3. Geologists generally have advised me that meteorites do not have an opportunity to become heated internally while traveling through our atmosphere. They burn externally but remain cold internally.

4. The answer to criticism 4 is given under two above.

5. Some specimens studied, notably the Johnstown meteorite, had little or no contact with the earth, being picked up immediately after falling, and hence this argument is invalid.

6. There is no valid reason for believing that bacteria similar to ours on earth might not have been evolved on other planets or in other systems in space.

To all the foregoing, I should like to add that a study of the data and observations given above will render invalid the obvious objection of contaminating or invading organisms as an explanation of my results. Too many cases of growth from inoculated meteorite powder into media are cited. In any given meteorite, like that yielding Series 377 or that yielding Series 393, there are altogether too many positive results to be accounted for by contamination, in the light of the extreme care with which the experimental work was done as described above. In fact, the author is convinced that in his zeal to prevent contamination of his

cultures, he employed measures for sterilization in various forms and phases of the work which were so drastic as to have destroyed some bacteria which were in the meteorites. While occasional organisms observed in the work may well be invaders, most of those described above cannot have been. This is especially true of such rare organisms as the autotrophic form found in Series 393 and the other more remarkable one found in Series 404.

ACKNOWLEDGMENTS

I desire to express my deep sense of obligation and gratitude for gifts of meteorite specimens as follows: for four specimens, to the American Museum of Natural History and especially to Messrs. Henry Fairfield Osborn, George H. Sherwood and Chester A. Reeds; for four specimens, to the U. S. National Museum, obtained through the kindness and interest of the late Dr. George P. Merrill: for three specimens, to the Field Museum of Natural History and especially to Messrs. S. C. Simms and O. L. Farrington; and for one specimen and one fragment, to the Colorado Museum of Natural History and especially to Mr. J. D. Figgins.

I also desire to express my gratitude to the President of the University of California, who, on advice of the Board of Research, allowed me a small grant for assistance each year to aid in the conduct of the work.

Finally, I wish to acknowledge my indebtedness to faithful assistants who have, at one time or another, carried on the laboratory work connected with my studies of the stony meteorites. They were Mrs. Dorothy Doyle Thomas, Miss Margaret Crawford, Miss Charlotte Krisher and Mr. Louis D. Greenberg. While I thank them all, especially Mr. Greenberg, for faithful service, no one of them is to be held responsible for the form and content of this paper, for which I assume sole responsibility.

AMERICAN MUSEUM NOVITATES

Number 589 | Published by The American Museum of Natural History New York City | Dec. 31, 1932

55.26

DISCOVERY OF COMBINED NITROGEN IN STONY METEORITES (AËROLITES)

By Charles B. Lipman

In connection with my studies on microorganisms in stony meteorites described in American Museum Novitates No. 588, I had occasion to study the accounts available in published form of the nature and composition of those interesting accretions to our earth. I was surprised in such study to note that no data were available in regard to the total nitrogen content of stony meteorites. This observation made me wonder whether any combined nitrogen exists in meteorites, and I determined to make some analyses to discover the facts in the case. Seven specimens of stony meteorites were analyzed for this purpose and the results are given in the table which appears below. The determinations were made by the modified Gunning method in three cases, and by the Micro-Kjeldahl method in the other four cases. The results were as follows:

Combined Nitrogen in Stony Meteorites

Name of Meteorite	*Percentage of Nitrogen*
American Museum of Natural History, No. 2416, Forest City, Iowa	.0052
Ward's Natural Science Establishment, Long Island, Phillips County, Kansas	.0064
Tilden Meteorite, Illinois	.0036
Ward's Natural Science Establishment, Gilgoin No. 2, Brewarrina, County Clyde, New South Wales (14.48 grams)	.0048
Ward's Natural Science Establishment, Holbrook, Navajo County, Arizona (12.35 grams)	.0016
Ward's Natural Science Establishment, Holbrook, Navajo County, Arizona (6.47 grams)	.0025
Ward's Natural Science Establishment, Pultusk, Poland (4.32 grams)	.0034

It is clear from the foregoing table that all the stony meteorites analyzed for nitrogen contain that element in combined form. While the percentage of nitrogen is in no case high, it is nevertheless of about one-tenth the magnitude of nitrogen in soils regarded as nitrogen-poor. Moreover, the Gunning or Kjeldahl method of analysis employed in this

study indicates that the nitrogen contained in these stony meteorites is probably there in the form of organic nitrogen. Tests made on the powder of three of these meteorites, for nitrates and nitrites, as well as ammonia, were all negative.

These analyses and observations are interesting in themselves as throwing light on the existence of a constituent in stony meteorites of which we have had no knowledge in them heretofore. But they are even more interesting and important in indicating that the nitrogen in question is in organic form; therefore lending more color to the thesis promulgated by me in another paper, Novitates No. 588, to the effect that living bacteria occur in stony meteorites. While the amount of nitrogen in these meteorites is small, it would be ample for furnishing a small bacterial population in the meteoritic substance with the nitrogen essential to their needs.